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Norton's Automatic Can Making Machinery.

We take pleasure in presenting to the public the illustrations, pages 1 and 2, representing a complete series of automatic machines for the manufacture of tin cans, such as are used in hermetically sealing fruits, vegetables, fish, meat and food products generally, as well as canning paints and all other goods requiring an air-tight package.

It is well known, that the consumption of canned goods has become well-nigh universal throughout the world, owing to the cheapness with which they can be supplied.

The present invention, producing as it does an entire change in the method employed in the manufacture of the cans used for the purpose of envelopes for this great product, should still further reduce the cost and in the same ratio increase the consumption of these goods.

Heretofore the bulk of these cans have been manufactured almost wholly by manual labor; various attempts have been made to introduce machinery, but from the fact that no complete system has hitherto been devised, only isolated machines having been used for doing certain operations in the process, they have met with but little favor.

During the past five years, Norton Bros., 40 to 46 River Street, Chicago, Ill., have been laboring persistently in this direction—the mechanical part of the work being in charge of Edwin Norton—and the illustrations show the method by which they have accomplished their purpose. The tin is fed in the sheet into a machine which cuts it into bodies, thence into a second machine which discharges the body, seamed up ready for soldering; next the side seams are soldered at the rate of 50 per minute by a very simple machine; thence the bodies pass into an automatic machine where they meet the tops and bottoms, fed down through chutes or hoppers, and they emerge at the bottom of this machine into an elevator with the ends put firmly on ready for the soldering.

It must be remembered that cans to be used for the purpose of "processing" (that is, having the article to be canned, "hermetically sealed") must be absolutely perfect—must be, in fact, miniature steam boilers. The mouth of each can being closed airtight, two rows of cans are carried along automatically up an inclined track and then down into a long tank filled with boiling hot water submerging the cans. The heat of the water expands the air confined in the can, and if there are any holes, no matter how small, the air escaping causes bubbles to rise in the water, which being seen by the inspector as the cans pass him leaving the tank, he removes the defective one, the finished cans passing from the testing tank through heated troughs as fast as they can roll on their way to the warehouse or to the packing room, emerging dry. From the time the tin in sheet form enters the first machine, it is kept continuously on its travels until it rolls into the warehouse ready to receive its contents. It is here that the great saving of labor occurs, the operation being continuous, and requiring the attention of but a few unskilled boys to produce a great number of cans daily.

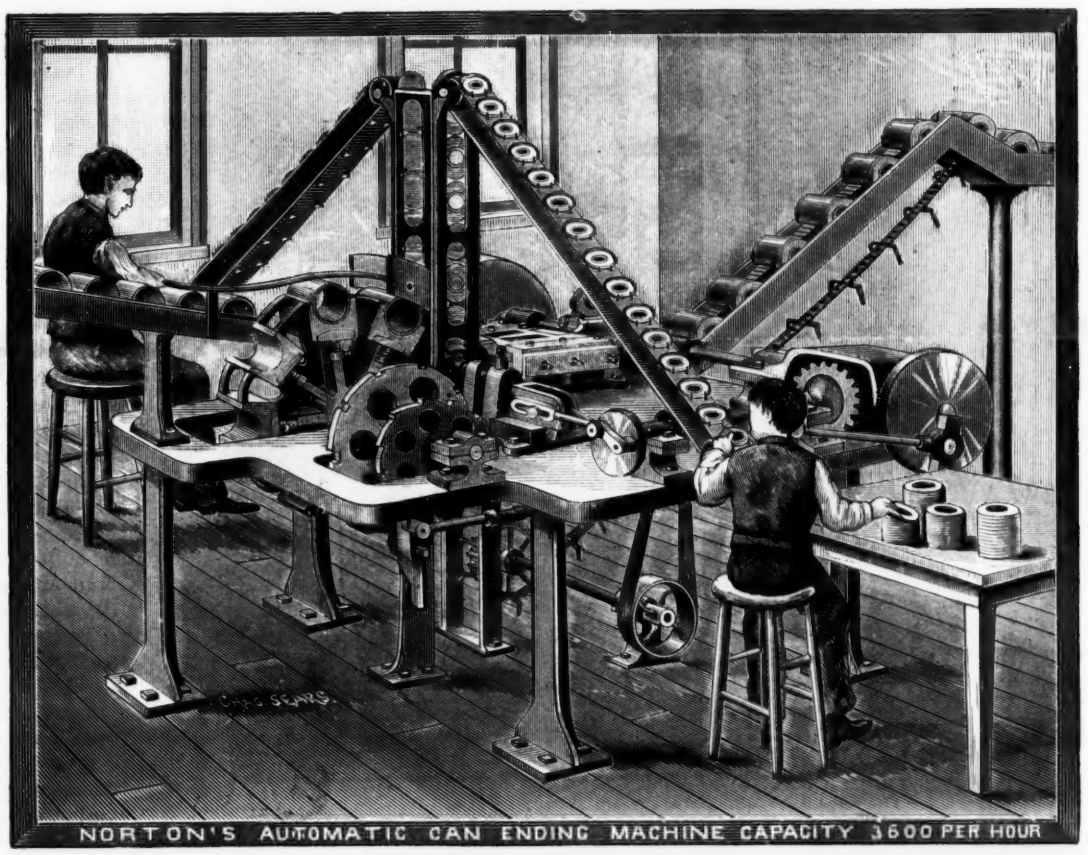
The capacity of the machine which solders the tops and bottoms is from 2,500 to 7,500 per hour, according to the diameter of the cans. The range of the machines is from the ordinary 1-pound salmon can to the gallon fruit can, and quickly changed from one size to another. The uniform size of the cans made by this system permits close fitting ends which effects quite a saving in solder over those made by hand, while the saving of labor is as six to one over hand-work.

The ends of the cans are cut in the ordinary manner, and brought to the can-making department in large trays, shown in the cut (page 2). The tin for the bodies is fed into the first machine, which automatically squares and subdivides it into bodies of exactly the right size. The next machine turns the locks, forms the body, and closes the side seam, being operated by an ingenious arrangement of cams and levers.

The next step in the operation is the soldering of the side seams. This is done by means of an endless chain carrier, each link of which carries a can body forward, first through a bath of flux, then up an incline which drains it out, thence through a bath of molten solder, the can body being carried by means of the links on a track shaped so that only the circular portion containing the grooved seam is immersed in the solder. As the cans leave the bath, they are carried up a sharp incline, which causes the molten solder to flow out, and the can then passes through a funnel, which rounds it up and supports it, while asbestos wipers, arranged below to bear against the seam, wipe off all the surplus solder into a box below placed to receive it. The cans are then carried forward over blasts of air, which cool and set the solder. The capacity of this machine is fifty side seams per minute, large or small, the larger-sized cans filling the chain, and delivering a continuous stream of finished seams.

The body having now been made and soldered, the next step is to assemble the body and the top and bottom. The cut on our first page fully shows this operation. Elevators made upon the link chain pattern raise the can bodies from the side seam soldering machine into the feed spout of the ending machine, which consists of an intermittently revolving turret, having a series of half moulds on its periphery. These, as the turret revolves, take up successively one body after another, a curved guard retaining them until they reach the bed-plate of the machine, where they register accurately with a corresponding half mould, which is mounted on a reciprocating crosshead and driven by means of cams from the main shaft of the machine. At the point where the moulds meet are vertical feed hoppers for the ends, which, being carried up by endless belts, are fed into these hoppers at the top. The heads feed down singly to the mould, where they are met by pistons mounted on a reciprocating crosshead and driven by a shaft at right angles with the main shaft, and having slotted links which give the proper time for a single end to feed down in front of the piston, which forces the end into the mould and upon the can body with the greatest accuracy. The reciprocating half mould and the pistons then withdraw, the turret revolves, and the cans are expelled from the machine by means of extractors working inside the moulds striking a stationary cam on the bed-plate of the machine. The cans fall into a trough, whence they roll into an endless link belt elevator, similar to the one described, which raises the cans and discharges them into the feeding trough of the machine (see page 2) which solders the top and bottom of the cans.

This machine consists of a double track, having two chains supported on idlers for rolling the cans along by friction; a heating plate, provided with means for heating the ends of the cans as they are rolling along, and a bath of flux and a solder bath. The cans are first heated, as above described; then passed through the flux; thence through the solder bath. As they leave the solder bath, one of the most simple and yet interesting appliances in the whole system is brought into use, viz., a tube having a projection and springs for turning the can into the vertical position, and placing it on its end on an endless belt beneath the solder bath, which carries the can back to the end of the machine where it first entered. During this trip they are subjected to cooling blasts, and at the terminus the cans are delivered on a table, whence they are taken up and put through the other side of the machine in the same manner, which solders the other end. Thus there are two streams of cans rolling forward and two coming back below, carried on the cooling belts, the last one discharging the finished cans on a trough, where they roll into the testing machine. The advantages of this system over hand labor are that the cans are more uniform in quality; and they have proved to be stronger under all tests to which they have been subjected.

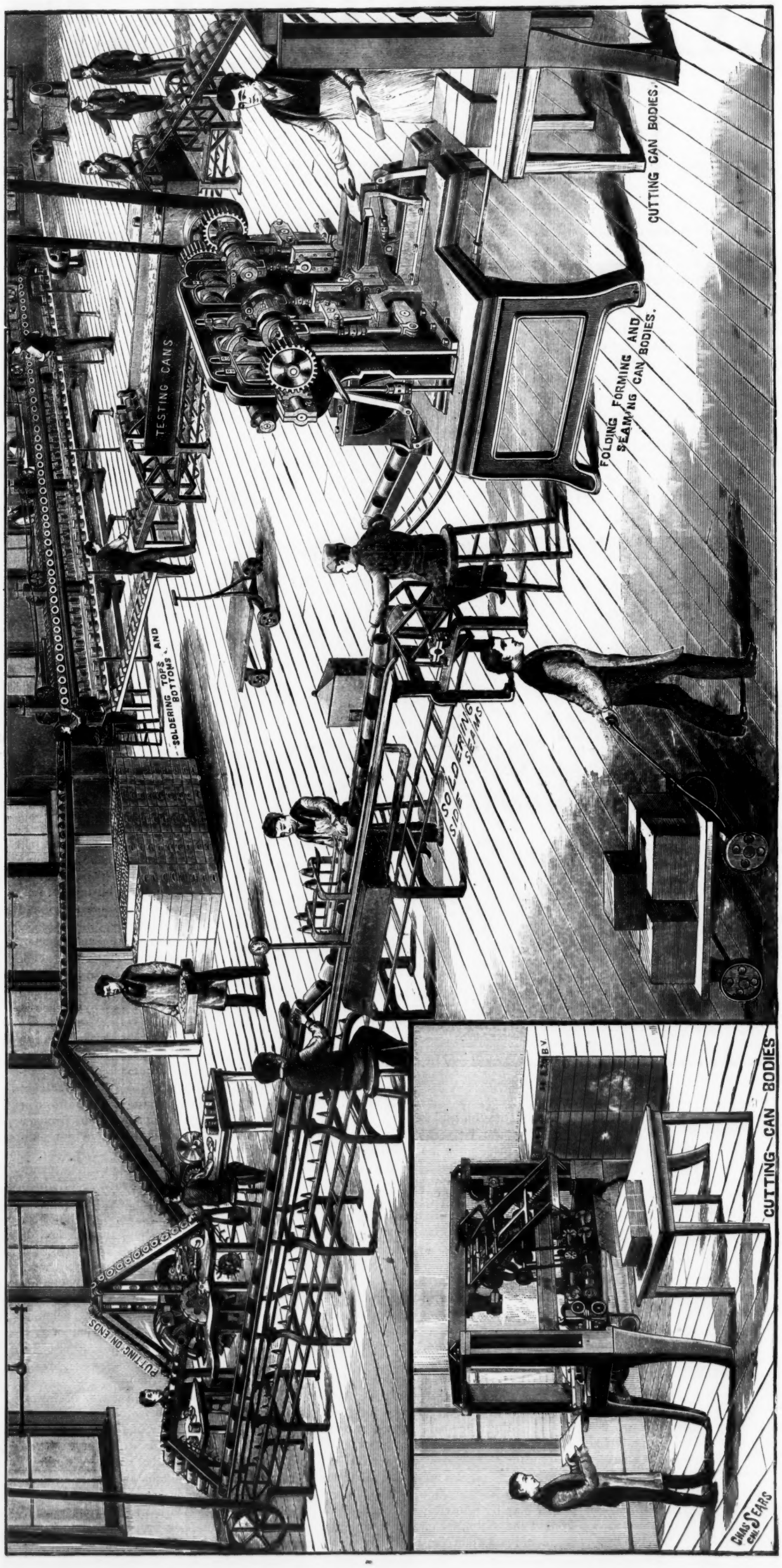


NORTON'S AUTOMATIC CAN ENDING MACHINE CAPACITY 3600 PER HOUR

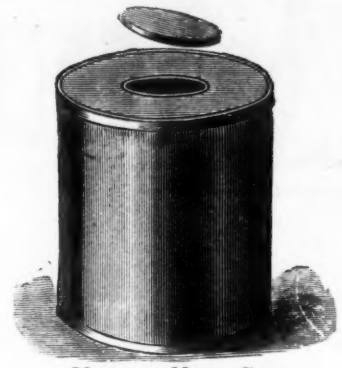
The rapidity with which they can be manufactured is remarkable, thus tending to equalize the supply and demand.

The Pacific Can Company, San Francisco, has been the first to adopt this method of making cans, and the first outfit has, we understand, been already shipped to them. It is the intention of the inventors and builders of these machines to bring them into general use as rapidly as possible, negotiations being pending for the location of factories in the Eastern States, and also in foreign countries.

The greatest obstacle in the way of forming definite conclusions from experiments is the fact that, generally, more than one experiment is tried at the same time. Hundreds of experiments that count for nothing would have been valuable in advancing both general and specific knowledge, if between them and others with which they are compared some addition or alteration had not been made, the presumed influence upon the result leaving the latter problematical.



Automatic Can Making Machinery at Work.—See page 1.



Machine-Made Can.

Extracts from Chordal's Letters.

TIME KEEPING IN ORGANIZED AND UNORGANIZED SHOPS—THE ABILITY OF A SHOP MANAGER TO ACCOMPLISH IMMENSE RESULTS LIES IN HIS POWER TO LAY PLANS—DIFFERENT BASES FOR FIXING A SELLING PRICE—ADVANTAGES OF A CASH SYSTEM—STAGES IN THE DEVELOPMENT OF A SYSTEM OF KEEPING COSTS.

Mr. Editor:

* * * Time-keeping in a small repair shop, or a small establishment of any kind, is one thing, and time-keeping in a large manufacturing concern is an entirely different thing. More difficulties present themselves in establishing a reasonable time-keeping system in a small shop, or instead of *small* I should say *unorganized* one, than in a large or well organized shop.

There are many reasons why this should be so. The large concern generally is, and always should be, under the control of some one man, or some one leading spirit. The very fact that one man manages a large concern carries with it the conviction that there there is some organization, some system, some predetermined course of procedure; otherwise the man don't live who can manage the large concern. You may subdivide the big thing as much as you please, and you may organize and systematize the subdivisions as much as you please, but if the entire structure, taken as a whole, is not based upon some plan of systematic organization it can't be managed at all; the concern will simply move and exist. It may be taken as a fact that a large, successful concern is a systematically organized one; more than that, it is easily managed; there is an atmosphere of order and system about the whole thing.

To establish a system of time-keeping in such a concern is a simple matter. Use forethought in the construction of the time-keeping system and have it executed the same as the other things are executed.

* * * Now, take the small concern, or the unorganized one; the very smallness of the business may draw to its head a manager of small mind. If the business is large and unorganized it shows that the management is deficient in a vital point. Be it either small or unorganized, or both, the management is difficult, arduous, harassing and aging. The possibilities of successful management are not to be measured by the size of the thing to be managed, but rather by the possibilities of grasp by the manager.

* * * The ability of one man to accomplish immense results—to do the work of 50 men, as the 50 men usually do it; to do it successfully, and smoothly, and uninterruptedly, and to do it without the exertion put forth by even the smallest of the 50, lies simply and solely in his power to lay plans; to look ahead; to anticipate contingencies and to prepare for them; in short, forethought. The power of that general force which moves things may be no greater, and need be no greater, and seldom is greater in this one great man than in one of these 50 little men; but the man with forethought wastes none of his power; he makes his mark before he begins to cut, and he thinks a little before he makes the mark.

* * * But I am getting away from the time-keeping subject. Assume a jobbing shop doing jobs of every character by the hour and pound, the cost of each job must be known, and all such shops have a method

of ascertaining the cost of these jobs. The method consists, when occasion requires it, in instructing the men engaged to keep a record of the time put in on a job; castings and forgings are easily traced up; babbitt metal is guessed at; the sum total forms the day-book entry. Experience gained in course of time shows a profit or loss, and leads to raising or lowering the selling price of an hour's labor or a pound of material. It does not seem as though anything more could be desired in a time-keeping system for such a shop. Briefly described, the system consists of a set of memoranda summarized into a day-book entry and then destroyed.

* * * Let this same establishment in the course of its growth undertake the manufacture (if I may use the term) of some merchantable commodity to be sold at a fixed price. How is the price to be fixed? A very poor concern will make its price entirely from the ascertained selling price of some other concern engaged in the same line; and this without regard to material variations in details of construction which may materially alter the cost of production. The other way is to keep the run of things, on one or two of the articles, in about as accurate a manner as the run of things would be kept on an odd job for Tom. Smith, and on the information thus gained to fix the price Many, and I may say most, of the concerns in the United States do their business in this way.

* * * Talk with the manager of one of these concerns about the importance of a thorough system of time-keeping (and by time-keeping I mean cost-keeping in all its phases) and he will say, "What's the use? First and foremost, the thing won't cost any less because I follow it up with a red tape system; and next, the red tape system is in itself more of a burden and more of a job than anything else in the shop."

* * * The manager who speaks thus is invariably a man who cannot comprehend a system in detail. He has never come in contact with the details of a system. He has met it casually as a sum total, and is terrified at its proportions. He may have attempted the thing in his own establishment, but if he has he has probably taken hold of the wrong end of it, or no end at all. It has presented the appearance to him of an immense tangle and snarl, and he has made a frantic grasp at the loop nearest to him. Such a procedure is bound to be worse than discouraging.

* * * Suppose that our friend, in the course of time, finds that his entire business is changed from a good deal of jobbing and a little manufacturing to manufacturing entirely. If he fixes the cost on Christmas, and fixes it with a good deal of guess in it at that, he will certainly find himself in trouble before the next Christmas comes round, and he will finally inaugurate a system of ascertaining the cost every once in a while, if it ain't too much trouble. This fixing of cost will consist in figuring up in some manner whatever the entire article, whatever it may be, seems to cost.

* * * The real cost system does not contemplate a frantic and expensive delving into uncertainties to find out what the thing seems to cost in order that a price may be fixed, but it contemplates a system which will show on its face the detailed cost of every procedure, for present or for future uses. Such a system in itself is not troublesome, but is trouble-saving; it is not expensive, but is money-saving; it is not useless, but is essential; it is not a luxury, but is a necessity to success; it is not red tape, but is a band of gold.

* * * To illustrate the necessity of forethought in a cost system, I will take the case of an unorganized shop. Assume that the manager determines on doing things up brown hereafter. He calls in his machine foreman and says, "I want the cost of every job hereafter." At the end of a month he finds that his foreman, in a general sort of a way, has brought him in totals on each complete piece of work. It is nothing more than the old plan of doing the thing, and is of no more value to him. He calls his foreman in and says, "This is the cost of some great big thing, when I want the cost of the details, and I can't tell anything about them by these big totals of yours. Why didn't you fix them so that I could?" The foreman simply answers, "Because you didn't ask me to." The manager says to himself, "I ought to have done it."

A golden idea strikes him, and he says, "I see it all now; I must determine in advance what I want and then ask for that. Here goes for new instructions. I want the cost of the details of the job; leave the totals to me.' The foreman says he would just as lief do that as the other thing, and he goes at it.

* * * Assume that the shop builds steam engines. The foreman did bring in the total cost of an engine, and now he is asked to bring in the cost of the details of the engine. He is supposed to be a foreman in a machine shop; he is now called on to define what detail means, and to elaborate an accounting system in a minute which looks as though it would require at least a respectable day's work to contrive. He does his best. He separates his engine into bed-plate, connecting rod, cylinder, crank-shaft, valve motion, fly-wheel, crosshead, piston and governor. After awhile he presents his cost to his manager, and his manager says, "Look here, this is no different from the other; before, you gave me the grand total on the engine without any items, and now you give me a lot of little totals on the items, without detailing the items. I don't want totals at all; I want the barest and nakedest items. What do you mean by crank-shaft? Does it include the crank and the crank-pin?" The foreman says, "Yes, of course." "And where is the piston-rod? I don't see it here." The foreman says, "That belongs to the piston." "And how about the barrel full of bolts that belong to the engine?" The foreman says, "They are charged up to the details they belong to."

The manager asks the foreman why he didn't give him the cost on every little thing, and the foreman says, "Because you didn't ask me to." The manager says to himself, "I ought to have done it."

A golden idea strikes him; he says to himself, "I see it all; I must determine in advance what I want and then ask for that. The foreman had as lief do it one way as the other, and here goes for new instructions. Give me the cost separately of every piece about the engine; leave the little totals and the big totals to me."

* * * This will break the average foreman's neck, especially if he is a good foreman and understands his business. If he understands his business, he is a mechanic, and not a clerk or an accountant. He has done the best he could, and, in fact, has carried out his instructions to a dot. His method has been to make the same general requests of his workmen that the manager has made of him. The work of making totals has fallen to him, and there lay the burden.

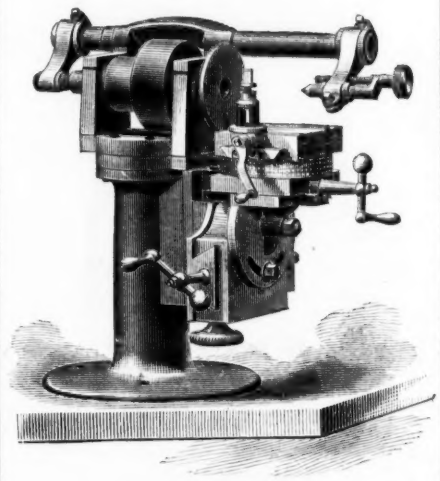
* * * If our worried foreman will look the matter squarely in the face, he will see that the more detailed the information required the less totals he has to fool with, and that his burden, instead of becoming heavier, has become lighter; and, furthermore, he will see that, in carrying out his present instructions, he has nothing to do at all, but to pass to his superior officer the data received from the men.

* * * But now, behold that, while our manager has arranged to secure an account of the cost of each piece in detail, and that, while the foreman has got rid of his work entirely, the poor workmen become burdened with making little totals on everything they do.

* * * Here we have one of the features of system cropping out. We see a great burden lifted from one man and distributed, perhaps, among a hundred others, and each one's share of this burden should be so light as not to be felt. It is not having one hundred men doing one man's work, which always means that the work is not being done at all, but it is making a hundred little pieces of work, one of which each man can accomplish with ease and certainty. In the case mentioned, the one man's big duty has been abolished entirely, and the duty of each individual man of the hundred has not been increased a particle, and the result is something worth having. Here is gain all around.

* * * Our plucky manager wants his costs in order, perhaps, that he may arrange prices for something which he contemplates building. The new thing to be made is not like anything he now makes, but if he knows the cost of the pieces of this engine, he will have a great deal of accurate information to guide him. But, before he goes very far, he finds that the pieces of this engine are not the same as the pieces of the new thing he thinks of building, but that the work on these pieces is the same kind of work which is going to be done on the pieces of the new thing to be built. The cost of the pieces of this engine is not what he wants, and he calls his foreman in and says to him: "These costs of yours don't tell me what I want to know. Here you say the cylinder costs so much, but how am I to know how much of this cost goes for the casting, and how much for the boring, and how much for the planing, and how much for the drilling and tapping? And then, how about the cost of putting this whole thing together? Why didn't you make your costs so I could tell what it costs to do each particular thing on each particular piece?" And the foreman answers, "Because you didn't ask me to." And the manager says, "I ought to have done it."

Again the golden idea; again the new instructions—"Give me the cost of every operation on every piece."



BENCH MILLING MACHINE.

* * * The foreman is now probably completely gone, and thinks he has got to the jumping-off place. There is no use of talking of scheming this plan out in a minute or in a day. The foreman, perhaps, decides that he was not made for that kind of business anyhow, and thinks the manager must have gone daft, or that he wants to turn his machine shop into a commercial college. He studies over the thing, and worries over it, but reaches no conclusion. He goes to the manager and pleads the impossibility of the thing, and the manager says, "Who bored that cylinder?" The foreman says, "Brown." "How did he keep his time?" "On the slate." "How did it read on the slate, do you think?" "It read, 'Boring cylinder, 9 hours.'" "Who planed the cylinder?" "Brown." "Does he run a lathe or planer, or both?" "He does anything, and is the best man we have on cylinder work, and I kept him on this thing especially because I wanted the costs kept together on that cylinder." "Well, how did his slate read?" "Well, I don't know. I suppose he added six hours to the time on the cylinder, or maybe he said, 'Planing cylinder, 6 hours.'" "Who drilled the cylinder?" "Brown." "Well, when Brown got done with this cylinder, what sort of a time account did he give you?" "Well, he gave it in as 'Cylinder, 22 hours,' and I weighed the cylinder myself when it first came into the shop, and thus gave you everything you asked for." "Well, now,' says the manager, "I'll tell you what is the matter. You have gone to a great deal of trouble and expense and inaccurate effort to get me total costs that ain't what I want at all. Now, when I ask you to go into the thing finer, you think the work will break your back. You tell your men to note on their slates what they are doing and how long they are doing it, and you send those slates in here. Is there any trouble about that?" And the foreman says, "No, not a bit; no trouble for me, and not a bit of trouble for the men." The manager says, "That is all I wanted." And the foreman says, "Why didn't you ask for it in the first place?" The manager says to him, "I didn't think of it; I hadn't traced the thing down."

* * * It looks like a lot of nonsense to thus trace up in detail time keeping steps until we reach, in a general way, a part of a method pursued in most every shop that has a time-keeping system. But I want to call particular attention to the fact that in machine shops the proper thing is a rare thing. There are some men so accustomed to the correct thing that they don't see the use in talking about the wrong thing. These men should see the inside of more shops. I have pointed out nothing good in time-keeping. In fact, this whole rigmarole has been intended to show that he who would introduce into his establishment a system of cost-keeping must first know himself what he wants, and must next provide means for fulfilling the requirements.

* * * I have probably taken hold of this time-keeping matter at the wrong end, and talked of the detail of a system before speaking of the scheme of the system itself. But I will explain matters to some extent, by saying that, in my opinion, cost accounts may be divided into—the detail data wanted, the method of securing, the method of checking and the method of posting them. The key-note, probably, to a cost system is in the proper itemization of the want. It is safe to say in regard to such matters, that, if you can determine just what you want to get, there is always some very nice way of getting it.

* * * Having commenced on time-keeping and slates, and such, I don't think I can do better than to devote another letter to exactly the same details of the subject, for the reason that, without regard to the general scheme, these details are, at least, essential.

* * * * Very respectfully,

CHORDAL.

The Griswold Bench Milling Machine.

The accompanying engraving represents a small bench milling machine, recently put on the market by Sweetland & Co., New Haven, Conn., and designed for general light work, for which an index machine is required.

The vise used with this machine is mounted on a swivel, upon the outside of which is an index, which can be used in cutting gears, or for other work where dividing is required. The vise, when it is desirable, can be fastened in any position by the operation of a binding screw. Underneath the swivel is a slide, which can be moved in a line parallel with the axis of the spindle, and below this a swivel which will permit the work to be tipped to an angle of 45° either way from the horizontal. This swivel is supported by a slide, which can be moved at right angles to the axis of the spindle, while the whole of the described mechanism can be moved on a slide on the column either up or down. These varied motions, as will be seen, provide for obtaining almost any desired angle in either direction.

By a yoke extending over the head a support is given the end of a long arbor, and the end play of the spindle is easily taken up. A tool-post is adapted to be used on the movable jaw of the vise, and by using the center in the spindle, in connection with the one in the yoke, the milling machine is converted to a small engine lathe.

A pair of centers (not shown) are furnished, which may be held in the vise and used in cutting taps, reamers and other work of the kind. These centers will swing three inches, and are provided with a worm gear for working.

The machine is neat and compact, readily set up, and very convenient for a large class of small work.

Coping, Venting and Jointing Green Sand Moulds.

BY THOS. D. WEST.

The proper coping, venting and jointing of moulds is very essential to the production of good castings. Many castings have their beauty ruined by an ugly joint. Irregularly shaped joints in a mould will test a man's ability as a moulder about as sharply as anything connected with moulding.

Some moulders will make such joints without the use of any judgment, while others adopt proper methods. The results can always be seen, in both instances, in the castings produced.

In the engraving I have endeavored to show a right and a wrong way of making the joints of irregularly parted moulds. As a rule, the larger the body of sand to be lifted the better the chances of successfully lifting it. The trouble is with the fine or small bodies. These fine bodies often require considerable manipulation, and the precaution of not making fine bodies or points of sand to be lifted, whenever they can be avoided, should always be taken.

It is astonishing how many moulders practice jointing irregular patterns as marked "wrong" in the engraving.

In machinery moulding irregular joints are generally lifted by the aid of "gaggers" and "soldiers" or by rods and nails, the gaggers and soldiers being used for plain surfaces and rods and nails for points and corners.

If a joint can be made so that gaggers can be squarely and evenly placed, and so rammed upon it, the chances of obtaining a good lift are improved. It requires but little penetration to see that in the engraving the part marked "right" presents a better bottom upon which to set gaggers than the part marked "wrong."

To lift a body of sand, or a joint, the less sand there is under the gaggers the better. Sometimes joint gaggers are set with no sand under them, but this is not generally to be approved of, as it does not make a neat joint, and might in case of straining at the joint cause the mould to blow.

When it becomes necessary to patch a joint, from not getting a good lift, it is usually very difficult to get it as perfect as it would otherwise have been. Sometimes the pattern can be set on the cope to assist in getting the required shape, but even then it can hardly ever be accurately done.

The best jointed castings are those where no joint-patching is required. The word patched is generally connected with botched, although it is easier to botch a job than to patch it, and some moulders who will do a good job of patching are far from being botchers.

At *X*, *V* and *N* is shown a plan of setting lifting bars that I do not, for two reasons, approve of. The first reason is that it compels the placing of the flat side of a bar parallel with the surface of the pattern, thereby often necessitating ramming and holding a thin, flat body of sand in its place. In ramming sand in such narrow pockets the best judgment must be used. If the sand is rammed too hard the gases will not escape, and scabbing will be likely to result. Another objection is that when it is necessary to roll the cope over, the thin, flat cake of sand is likely to drop off.

I always try to have bars for lifting out pockets or carrying hubs or other projections arranged so there will be a considerable body of sand around them. This not only lessens the danger of bad results, but gives more room for ramming up and for seeing what is being done.

The second objection to using bars in pockets as here shown is that setting the gaggers is inconveniently done, and the danger of a drop-out is increased.

In this cut three plans for making deep pocket joints are shown.

At *A* is represented a plan that will give a free lift, but involves setting more gaggers, and unhandy ramming.

At 6 and 9 is shown how this plan of barring causes gaggers to be set, which makes the ramming awkward, marks the joints, and does not securely hold the sand.

At *B* the joint is made more nearly vertical, by which the above objections are to a great extent removed.

In making a joint for such partings the more nearly vertical it can be made the better —4″ slant to a foot in height will generally work satisfactorily.

At *K* is represented a plan sometimes resorted to on the plea of lack of room, poor tools, etc. The plan shown at *A* is much better than this.

Numerals 1, 6 and 9 represent lack of judgment in trying to lift a body of sand. The gaggers seem to be set on the theory that if they are only gaggers that is all that is required. The sand at 9 would be more likely to be lifted if the gagger was not used, as its length is only about that of the body of sand to be lifted, and iron is heavier than sand.

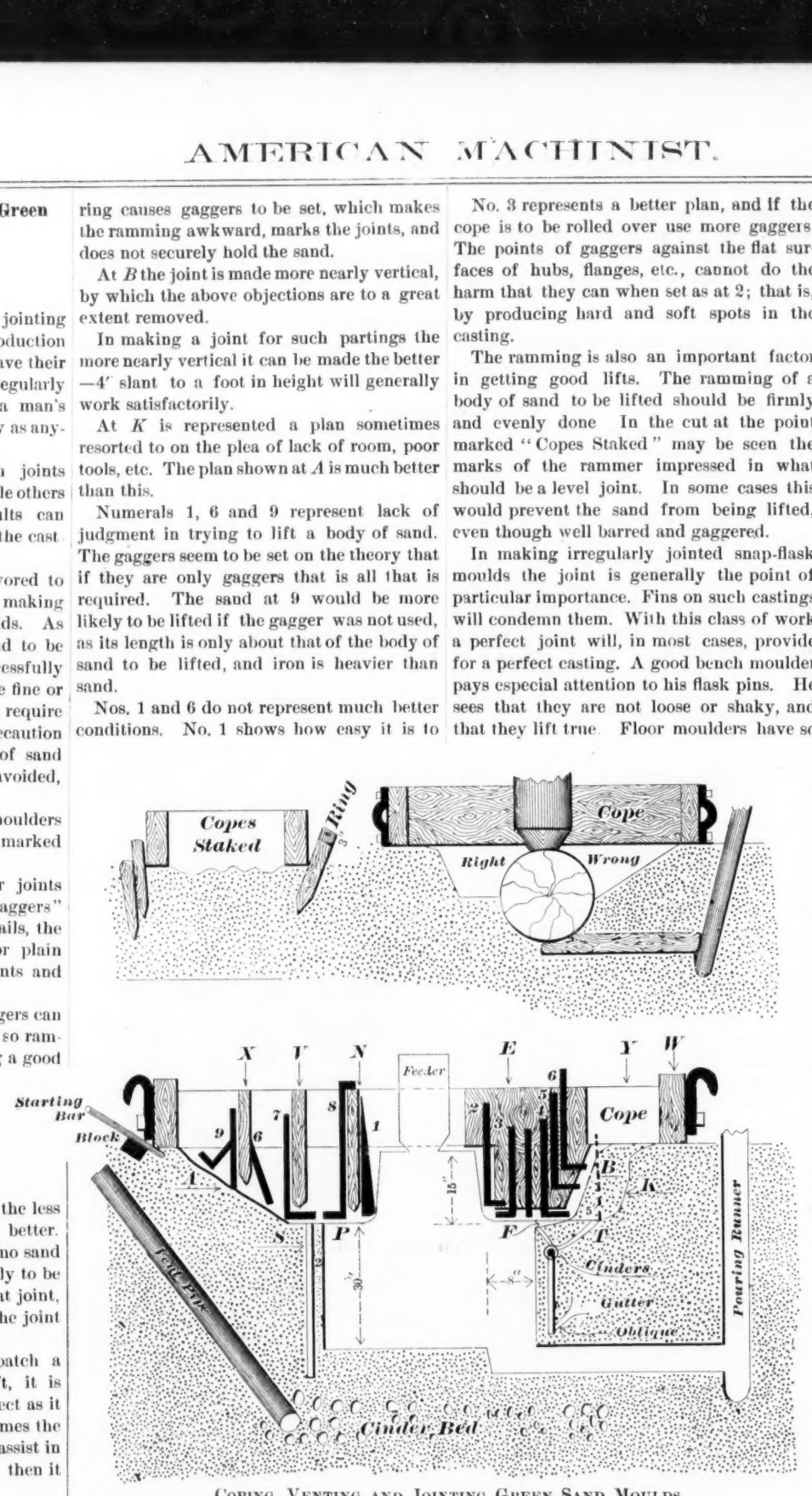
Nos. 1 and 6 do not represent much better conditions. No. 1 shows how easy it is to put one clumsy gagger where it will do the least good, or where there should not be any.

If I could not have bars as at *E*, and it was necessary to set a gagger at 1, I would keep it up about 3″ higher and turn 8 the reverse of what it now is, so as to bring the point of the gagger under the bar towards the hub.

The hook shown on 8 is generally made only on wrought iron gaggers. It is often serviceable for carrying heavy bodies of hanging sand. In some shops wrought iron gaggers are used almost exclusively, while in others cast iron ones have the preference. I prefer those of cast iron, for general use, as they will not spring, are cheaper to make, and can be readily broken off to any desired length.

I am aware that some will object to breaking gaggers, and that in some shops the rule is that they shall not be broken, but before I would allow them to be left sticking out of a cope, as at 6, I would have them broken so as to come no higher than 5. Gaggers sticking up, as at 6, are liable to be hit, resulting probably in losing the casting. I never allow gaggers to be left standing above the cope, and should any one be discharged in a shop of which I was foreman for bad results from this cause it should be me in preference to another. One of the risks that foundry foremen can prevent is the improper exposing of gaggers.

Gaggers 4, 5 and 6, in connection with the bars as at *E*, represent good practice. Gagger 2 shows how gaggers are sometimes set by the side of deep hubs and flanges.



COPING, VENTING AND JOINTING GREEN SAND MOULDS.

No. 3 represents a better plan, and if the cope is to be rolled over use more gaggers. The points of gaggers against the flat surfaces of hubs, flanges, etc., cannot do the harm that they can when set as at 2; that is, by producing hard and soft spots in the casting.

The ramming is also an important factor in getting good lifts. The ramming of a body of sand to be lifted should be firmly and evenly done In the cut at the point marked "Copes Staked" may be seen the marks of the rammer impressed in what should be a level joint. In some cases this would prevent the sand from being lifted, even though well barred and gaggered.

In making irregularly jointed snap-flask moulds the joint is generally the point of particular importance. Fins on such castings will condemn them. With this class of work a perfect joint will, in most cases, provide for a perfect casting. A good bench moulder pays especial attention to his flask pins. He sees that they are not loose or shaky, and that they lift true. Floor moulders have so many other things that claim their attention that the joint is not given the attention it deserves. It is apt to be thought if the casting is all right with the exception of the joint, that a chisel and file will soon fix that. The quicker such ideas are got rid of the better.

A floor moulder should take the same pride in the joints of his castings that the bench moulder does.

In small work there are two objectionable joint features. One is the fin and the other "overshotness." In heavy work the fin cannot always be avoided, but overshotness can always be.

The stake marked "Ring" shows how stakes are often driven, thereby providing for bad lifts and overshot castings. The stake on the opposite side is driven correctly. The ring on the stake is made by cutting off pieces of wrought iron pipe of the proper diameter. They are good for protecting the stakes from the blows of the sledge-hammer.

In staking flasks at least two-thirds the length of the stake should be driven in the ground. Sometimes for greater surety it is advisable to drive two stakes—one behind the other.

With good sand or plaster-paris mould-boards the skill and labor of making partings or joints is saved. It is where joints must be made by hand that the skill of the moulder is tested.

With some irregular light mould joints it is often advisable to start up the pattern when the joint is nearly completed. This will show if all parts have been made so that the pattern will draw freely. The pattern is then to be lightly rapped into its bed and the joint completed. Then the cope is rammed and lifted and the pattern withdrawn.

It is often a good plan to arrange for rapping the pattern before the cope is lifted off. This is done by having rapping plates on the pattern, if of wood; or having holes in the pattern, if of iron. Then when ramming up the cope ram up gates in the holes, and when withdrawn a pointed bar can be set in the pattern and lightly rapped in all directions.

With copes where two or more men are required to lift them, it is often a good plan to raise the cope an inch or two by slightly raising a corner at a time, inserting a wedge to hold it up.

Again, it may be advisable to raise one end or side at a time, but in either case the corner, end or side should only be raised a small distance—sometimes not more than $\frac{1}{16}$″ at a time at first, which distance can usually be increased at each successive lifting.

In order to assist in getting good lifts with a crane, iron starting bars are sometimes placed, as shown. Usually the first starting of the cope is the most important. If it is started so as to jerk one side up before the other, the most careful gaggering, ramming, &c., will have been of but little avail.

There are two more points upon which I will express an opinion, and which may be of interest to those moulding heavy work. At *F*, in the lower cut, is represented a plan of cutting fins, which may be new to many. Of course, fins are objectionable, and should be avoided upon light castings, and upon heavy ones where the joint is on the surface, as in columns and similar castings. But for heavy castings, where the cope surface is level at the joint, or the mould does not project up into the cope, as shown at *P*, *F*, cutting fins is often advisable, for two reasons: The first is, that in drawing heavy patterns the joint of the mould is to a greater or less degree started. This may be sleeked down, but to get the benefit of any doubt it is often wise to cut for a fin. Of course the idea is, to be sure the cope does not touch the mould at the joint. They should run from the surface of the mould back from 2″ to 4″, wedge shaped, as shown. The thickness of the fin at the mould should be determined by a consideration of the degree to which the mould is started in drawing the pattern, and to some extent by the temperature of the iron to be poured. For dull iron the fin should be thicker than for hot iron. For safety, and to assist in getting good heavy castings, they are usually poured with dull iron. In pouring dull iron the upper edge or surface of the casting is likely to be wavy, presenting the appearance of cold shut. Cutting a fin is to some extent a remedy for this, at the edge of the casting, as it assists in the escape of the confined air and gases, or permits them to be held in a space which if the metal does not fill no harm will be done. Observing moulders know that an open sand casting can, by pouring with dull iron, be made from $\frac{1}{8}$″ to $\frac{1}{4}$″ thicker than the mould, for the simple reason that the top edge runs rounding, allowing the surface to run higher than the edge. Coped castings would run in the same way were it not for the fact that the head pressure forces the metal into filling the top edges; but this head pressure is sometimes insufficient to fill the edges. In the case of a mould in which a fin is cut the chance of the above occurrence is measurably lessened, and the thicker the fin the greater the extent to which it is lessened.

The sides and under portions of moulds are often vented direct from the surface of the joint, as on the side *P*. Venting, as at *S*, is not always reliable for heavy castings, because there is a chance that the metal will get into the joint; it also makes the management of the joint laborious. On the side *F* is represented a far more reliable way to vent such moulds. When the pattern is rammed up to within from 4″ to 6″ of the joint, the side is then vented and cinders placed, as shown. The remainder of the depth is then

rammed up and vented down into the cinders, no signs of joint vents being visible. At *T* is shown how the vents are carried away from these cinders. A row of vents are made from the joint surface to the cinders, the joint vents being kept back from the edge of the pattern from 6″ to 12″. In some cases this plan will work well without the use of cinders, by venting down directly from the joint surface and stopping up the holes so they will not be seen. The vents *T*, being thickly inserted, will indirectly bring the side vents to the joint surface.

Sometimes, to make joints more secure, and to keep them free from vent holes, channels of cinders might be connected with the cinders shown, and led out as far from the mould as desired and connected with surface outlets, which could be done by ramming up vent sticks, or by digging down after the mould is ready for pouring.

The cinders shown are placed very near to the pattern surface, so they will cover the side vents. Placing cinders so near a surface may sometimes be objectionable, because they weaken the surface of the mould so that the head pressure may strain the casting. In case of apparent danger from this cause, the cinders may be kept back 4″ to 8″ from the pattern surface, and by making a gutter the vertical vents can be connected with it by oblique vents. The wire for these vents may be ¼″. It should never be allowed nearer than 2″ from the surface of the pattern, and should be kept parallel with the face of the pattern.

If the moulding sand is clayey, or too fine, it is sometimes advisable to vent vertically with ⅛″ wire, the vents being near together and within about 1″ of the face of pattern; this in addition to ¼″ wire vents. In fact, this last-named plan will always help to assure good results, the only objection to it being that it takes time to do it.

Some sands are so open that the sides need be only vented with the fine wire. When this is the case, the venting is done at each alternate ramming until the top of the joint is reached. If it is not advisable to carry the vents off by cinders, as shown at *T*, they can be taken up direct through and off at the surface of the joint.

Another plan sometimes adopted, is to carry the side vents down to a lower cinder bed (when one is required under the mould). By this plan, the gases, which would rise naturally, are forced down. A mould will not free itself so easily when vented in this way as when the gases are permitted to rise.

In venting very deep moulds that require hard ramming to prevent straining, I recommend that every other course be vented with ⅛″ wire, and at about every 18″ of depth make a gutter about 4″ from the face of the pattern. From this gutter vent straight down to the lower stratum of cinders with a ⅜″ vent wire. Small, oblique vents can also be made between the vertical vents, care being taken not to touch the pattern, which might permit the iron to find its way into the large vents and cinders. This oblique venting, however, will hardly be required if all the space between the large ⅜″ vents and the pattern is well vented.

LETTERS FROM PRACTICAL MEN.

A Simple Calipering Tool.—Making Paper Scales.

Editor American Machinist:

Three years ago, having about one hundred keys to forge from the same pattern, I devised a tool, same as enclosed sketch, to caliper the taper. It is simply two pieces of 1½″ angle iron. The drawing explains itself.

The merits of the tool are: The smith can not burn it; it is cheap and nasty, and is there every time.

As it may be of service to our young draughtsmen, and probably to some of the older hands, I wish to make known a method I have lately adopted in making paper scales.

At the end of the proposed scales I cut out a piece of the paper, ¼″ wide and about ⅜″ longer than one main division, and in this space insert a piece of isinglass.

On the drawing-board make center line, *AB*; from *B*, as a center, measure back 30″, or any convenient distance, and describe the arc *cd*; lay off 1½″ each side of *A*, and divide enclosed space into 12 equal parts. Then, as *cd* : *AB* :: one main division of proposed scale : the distance the scale should be placed from *b*.

Having fixed the scale in its proper place, insert a fine needle at *B*, and with the straight-edge resting against the needle and cutting the divisions on *cd*, draw with a fine point the intended divisions on the isinglass.

A. WALLACE.

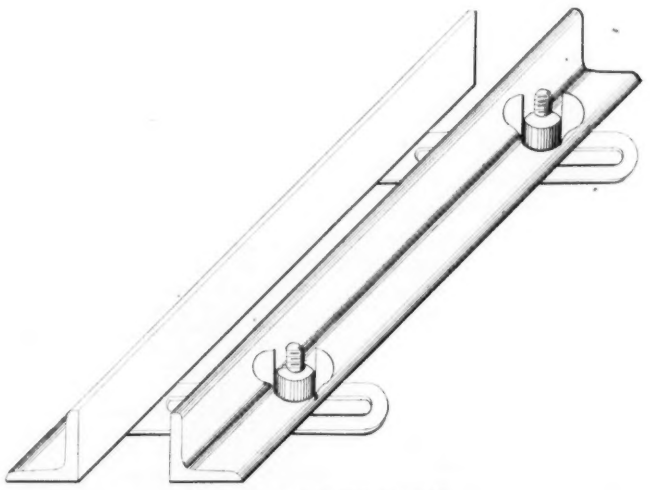
Leadville, Colorado.

Dimensions of a Cupola for Melting with Coke.

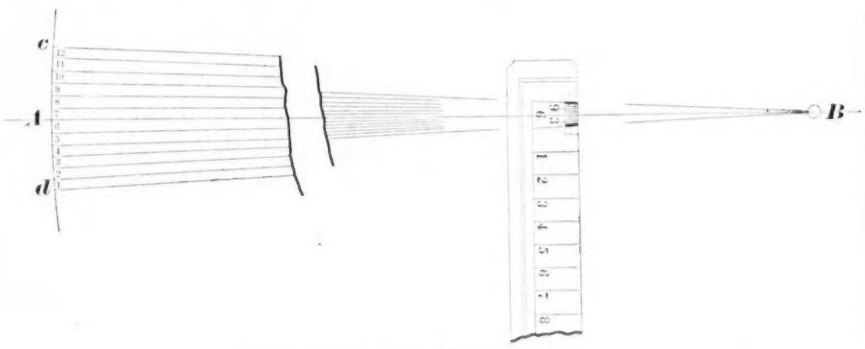
Editor American Machinist:

I notice in your issue of 9th instant some data by Mr. Gardner, foreman of the Pratt & Whitney Co's. iron foundry, in reference to the use of coke and coal in melting iron, and as some of my experience in the use of coke may be of interest to your readers, in the iron business, I take pleasure in presenting some data.

In constructing a new foundry, after some consideration, I adopted the following dimensions for a cupola, blower, and engine. The shell of the cupola was made of No. 12 iron, 42″ in diameter, of a height sufficient to carry the top about eight feet above the roof of the building. Commencing twelve inches above the base plate is a wind belt 36″ high, with an air space of 4″ between it and the shell, this belt being riveted to the shell. The tuyeres are six in number, and 3″ in diameter, equally spaced around the shell and 18″ from the center of opening to the base plate, which has the usual drop doors underneath.



SIMPLE CALIPERING TOOL.



PLAN FOR MAKING PAPER SCALES.

In the wind belt, opposite each tuyere, is a peep hole 3½″ in diameter, with a one inch opening in the cover, with mica. The distance from the tuyeres to four auxiliary tuyeres, 2″ in diameter, is 24″, these openings being for the purpose of admitting an additional quantity of air to the carbonic oxide formed above the lower tuyeres. From the base plate to the bottom of the charging door is 9 feet 6 inches.

At the center of the height of the wind belt, or the back side opposite the top hole, is an opening 12″ in diameter, to which is attached the blast pipe. The engine used was a "Haskin's" four horse power, 5″x5″, speeded to two hundred and thirty revolutions per minute. A five inch belt from the 24″ fly-wheel on the engine run to a countershaft above, and thence two belts down to a number five "Sturtevant" blower speeded 2,900 revolutions per minute. Both engine and blower were set on the extension of the charging floor, the blower being about ten feet from the cupola, to which it was connected by a twelve inch galvanized iron pipe, a tapering piece about two feet long being made to fit the mouth of the blower, eight and three-quarter inches in diameter.

The cupola was lined up to the top of the charging door to a diameter of 30″ with fire-brick, and from there to the top of the shell with one thickness of red brick edge to the center. In the melting of about 750,000 lbs. of iron the heats ran from 3,000 to 14,000 lbs., and the general mixture was one-third Thomas No. 1, and Glengarnock (Scotch pig) two-thirds. The fuel used was solely English coke, and the charges were as follows: Fuel on the bed, 600 lbs.; next two charges of fuel 200 lbs. each, and each succeeding charge of fuel 150 lbs.

The charge of iron wire, on the bed, 3,000 lbs.; the next two charges each 3,000 lbs., and each succeeding charge 2,500 lbs.

The largest or heaviest heat made was a total of 14,000 lbs. of iron melted, the time required from the putting on of the blast being two hours. The fire was usually lighted one hour to one hour and a half before putting on the blast, and from ten to fifteen minutes after the blast was put on the furnace would be closed up. The pressure of blast never exceeded a column of water sixteen inches high. This may seem rather a light blast, but I always found it sufficient. I know that it used to be a chronic complaint of melters that if anything went wrong and the iron did not come down that there was no blast, and I have under other circumstances tried pressures up to a pound and a half, with the Mackenzie blower, without as good results as with one-half that pressure; that was with coal; but with coke I found the pressure required was much less, with faster melting, a softer, tougher iron, and more economy in fuel. The amount of iron melted, as alluded to before, was completed in ninety-nine heats. Of course, as the bed charges of fuel were constant, with light heats the fuel consumption would be greater per pound of iron melted.

With this furnace the charging door was not so hot as in most other cupolas that I have used, or others that I have watched belonging to different foundries. During the working of this cupola I felt satisfied that the results were not more than might be attained ordinarily with intelligent supervision and proper care in charging.

San Francisco, Cal. W. W. HANSCOM.

The *Fireman's Herald* mentions a recent trial of a horse-power fire engine in New York City.

"The trial was very satisfactory in every respect, and many expressions of commendation for the new machine were heard. Streams were thrown through nozzles of various sizes and various lengths of hose. The pressure and height of streams attained excited much admiration. The engine was worked in all manner of ways, by one horse, two horses and four horses, and by men and by boys, and in each case it did satisfactory work."

According to the *Engineer and Iron Trades' Advertiser*, of Glasgow, last year was the busiest season among the shipbuilders on the Clyde they have ever experienced, and, so far as 1883 has gone, the activity has increased rather than diminished. During May nineteen screw steamers were launched; also a few smaller vessels. A lull, which is expected to gradually develop into dullness, is now visible. Shipbuilding, our contemporary declares, has outrun the demand, and is creating a lower range of freights. British tonnage in the foreign trade has trebled in the last twenty years, but the demand for freight room has not correspondingly increased.

Master Mechanics' Convention Notes.

The first paper read was on "Improvements in Locomotives with Reference to Efficiency and Style of Finish," by F. W. Dean, associate member. The paper was read by the secretary.

In opening his subject, Mr. Dean alludes to the increasing attention being paid to locomotives, and the fascination which the theme possesses for so many persons. In the construction of locomotives, he considers that sound design is often sacrificed for appearance, and that many persons who plan locomotives are not well versed in first-rate principles of machine design and constructive mechanical engineering.

Some of the principles which should be kept in view in designing a locomotive are simplicity, directness, convenience in manufacturing, inspecting and repairing. A locomotive or other machine should be as smooth and free from projections of all sorts as possible, so long as these features are not inconsistent with the efficiency of the machine. In particular, all nuts and other parts should be conveniently placed, and no attempt should be made to conceal anything, for the minute this is done there enters what may aptly be termed mechanical immorality. The means which we employ to fasten parts together are the best we have, and should be honestly used. The beauty of a machine consists largely in the propriety of the design, and any departure from propriety is a caricature.

The writer believes that sand boxes and dome covers should be perfectly smooth and without mouldings. They should have hemispherical tops, and should flare out to join the boiler. In this particular, Mr. Ely, the late Howard Fry, and Mr. Lander have set good examples.

The forms of cylinder casing should receive more attention. This should be entirely without mouldings, should have flat ends, and the parts joined should be flush with each other. It would be well to consider whether, for the sake of simplicity at least, cylinder heads without casings, cannot be used with advantage more than they are at present. If they were used in conjunction with solid web pistons, which will be noticed farther on, they could be made hollow, thus giving an air space for the non-conduction of heat. The objection to this construction are the cost of founding and the weighting. On the other hand, the gain in strength due to this form, when the two webs are connected by ribs, may be an important advantage with the increasing steam pressures which are sure to follow the few leading instances of it which we now have.

Occasionally we hear of the burning of locomotive cabs. In England and on the

continent of Europe, as most of us know, iron is always used for cabs of a thickness of about three-sixteenths inch. The roof is sometimes made of wood, easily detachable from the sides and front, and is covered with some waterproof material. This overcomes the objection that an iron cab would be noisy in rainy weather, but the objection that it would be cold in winter and hot in summer may have considerable force. The weight of an iron cab would be an advantage in these days.

Having considered, therefore, matters relating mostly to the appearance of locomotives, he proposed to treat in some detail certain parts of the American locomotive, in order to see whether some improvement cannot be made in their efficiency.

The American locomotive is a remarkably wasteful machine, both in the use of the fuel and the use of the steam after it is generated.

Mr. Dean regrets that we have so few records that can be relied on to show our locomotive performances, and hopes that experts will soon be employed to obtain the needed data. He furnishes statistics of work done by locomotives on the Great Northern Railway of England, where 28 pounds of coal per mile was used in pulling a train of 213 tons at a rate of 50 miles an hour. In this country, 50 pounds of coal was consumed per mile in working a train of 350 tons at the rate of 35 miles an hour.

In seeking the cause of the great consumption of fuel in our locomotives, we must recognize the fact that they are pushed frequently to their utmost capacity, and it is evident that the tremendous rapidity with which the combustion takes place is chiefly responsible for it. In stationary practice a consumption of more than 40 pounds of coal per square foot of grate area per hour is unusual, while in locomotives as much as 130 pounds is sometimes burnt. The chief cure for this evil is an increase of grate area, and this can be accomplished (while keeping the fire-box between the axles) by using a plate frame $1\frac{1}{2}$ inch thick, and the Joy valve gear, which allows the fire-box to be brought up close to the forward driving axle. In this way the width of a fire-box can be increased $5\frac{1}{4}$ inches over the usual width with bar frames, and the length can be made 84 inches, giving a grate 84 inches by 41 inches, the area of which is 23.9 square feet against 17.6 square feet, the amount usually found in locomotives with their driving-axle centers 8 feet 6 inches apart. This is a gain of 6.3 square feet, or almost 36 per cent. If, now, an engine with the smaller grate area should burn 100 pounds of coal per square foot of grate area per hour, a similar engine with the larger grate area, but burning the same total amount of fuel, would burn only about 75 pounds per foot of grate. The consequence of this slower rate of combustion would be that a larger exhaust nozzle could be used, less coal would be pulled through the tubes, fewer sparks would be sent out of the chimney, there would be less back pressure in the cylinders, and a considerable gain in economy would result.

He liked the recent practice of extending the smoke boxes to catch sparks, but thought the sparks should be stopped from leaving the fire-box by brick arch or other devices. He thinks that enough air does not get through the grates for complete combustion, and recommends that the engines be run with the fire door partly open. Air deflectors are a decided improvement, and their use should be encouraged.

The frames of American locomotives, Mr. Dean considers, take up too much room, and they lack vertical stiffness; so, he recommends the British slab frame as a substitute and improvement.

Regarding the construction of boilers, he makes eleven distinct recommendations, expatiating upon each of them. Most of his views coincide with the practice followed by our best makers, but on several points his recommendations are novel. He asserts that the screwed stay-bolts should be placed further apart, and their ends cupped with a button set. Use no dome, but rather take steam through a perforated pipe, as it is drier than dome steam, and the boiler is less likely to prime, while domes are a source of weakness and expense.

The ordinary coupling rod, connecting rod, crosshead and guide are not what they ought to be. Coupling rods with bushed eye-ends are simple, cannot be tampered with, are beautiful to look at, and have been known to run three years without renewal.

The 4 bar guide, which is so common, is weak, expensive, and is perfectly exposed to dust. This should give way to some other form; for example, to a cast-iron bored guide, cast solid with the back cylinder head.

This is the most perfect form of guide and crosshead yet devised, because, among other things, the cylinder head can be turned in the machine which bores the guide and at the same time, thus insuring perfect alignment. When the opposite driving wheels are at different levels, it will allow the crosshead and piston to revolve, thus doing away with twisting the connecting rod, wear on the edge of the guide bars, and grooving of the bars and cylinders. Moreover, it allows the upper bearing guide surface, on which nearly all the wear takes place, to be wider than the lower, and it can be boxed in and protected from the dust. In a word, it possesses very valuable features.

Breakages of rock-shafts now and then occur, and the question arises whether it would not be an improvement to make them of gun iron or steel castings, larger in diameter than usual, and hollow. In this way a better casting would be probable, and the metal would be better distributed, weight for weight, than in the ordinary form.

Solid pistons have the advantage of simplicity and cheapness. As they are almost exclusively used in England, it would seem that they would be successful here if understood.

As the best material for coupling rods Mr. Dean recommends solid drawn weldless steel tubes, which he says would be strong, light, elastic and reasonably cheap.

The Joy valve motion he considers the best ever devised for a locomotive, and destined to supersede the link.

Besides the cheapness of the gear, its accessibility, accuracy, the possibility of excluding dust from the wearing surfaces, the opportunity for increasing the grate area on account of the absence of eccentrics, its capability of allowing the steam to follow the piston nearly to the end of the stroke, its rapid opening and closing of the valve, the small area of frictional surfaces, and the ease of handling, are excellent features.

In conclusion, the writer says that it has been his aim in this paper to draw attention to the fact that there are simple ways out of the dilemma in which master mechanics now find themselves when asked to draw heavy trains at very fast speeds, and to show that the present type of locomotive has not outlived its usefulness, as some inventors think, but is capable of considerable extensions in various desirable directions, all contributing to its cheapness, power, economy and durability.

When Mr. Dean's paper was called for discussion there was a disposition manifested among the members to let it pass, when Secretary Setchel rose and expressed unwillingness to let the opinions in that paper be accepted as endorsed by the association without comment. He believed that Mr. Dean was a young man with little experience, and his theories advanced were mostly of English extraction, some being correct, but many of them impracticable.

Mr. Setchel could not see wherein iron cabs would be an advantage in any way, as they possessed many objectionable and dangerous points. The iron cab proposed by Mr. Dean would be lighter and weaker than our wooden cabs, and in case of accident it would crush up and be more dangerous to the occupants.

Respecting the charges that the American locomotive is very wasteful when compared with English locomotives, he doubted if anything about the design was to blame. The difference was due to difference in operating. English engines were so carefully fired that every point of economy that could be reached was gained. This enabled them to make a better record than the ordinary run of our engines. But efforts were now being made to enlighten our firemen on the proper methods for doing their work, with the very best results On the Cincinnati Southern, where they had been training firemen away from the vicious practice of piling in coal till a continual cloud of black smoke poured from the stack, they had effected a saving of from 25 per cent. to 33 per cent. in fuel. They had adopted the extended front end, but he did not consider that device any saving of fuel in itself, its advantage being that the engine would not make steam freely unless fired light. Another reason why we do not make as good a record as Old Country locomotives is that our engines are pushed more than theirs. It is not that our engine is not so good as theirs, but because we do more work with it.

Mr. Dean advocates running with the door open, a practice which Mr. Setchel showed to be all wrong. In the first place, it is impracticable, for our locomotives would not steam with the door open, and opening the door is destructive to the fire-box sheets, and should be avoided as much as possible. Then it would be a useless waste of heat to let the cold air rush in over the fire. About steel deflectors, which are recommended in the paper, Mr Setchel believed it to be the experience of all Western men that the water deflector is a failure. In most cases it had been taken out because it could not be kept in. It would burn out and crack, and as a substitute, they have put in the brick arch. To leave the brick arch and take up the water table would be retracing our steps.

Mr. Setchel did not agree with Mr. Dean that a slab frame was best, but he was willing to yield a point for the sake of getting a wider fire-box, and slab frames had been used with success by Mr. Eddy, of the Boston & Albany Railroad.

In regard to stay bolts, Mr. Dean suggests that they be put further apart, but he would prefer to put them closer together than what is our present practice.

Mr. Setchel could see no advantage, and many disadvantages, that would follow abandoning the dome in favor of a perforated dry pipe. It is a mistake to imagine that a dome full of steam is of no value. In regard to guides and pistons, he agreed in a general way with Mr. Dean that improvements might be effected by adopting stronger patterns.

Mr. Sprague, of the Porter Locomotive Works, objected to leaving the mouldings off sand boxes and domes. He believed we should consult looks about a locomotive as much as we do about a house. The symmetrical lines and mouldings made American engines attractive to the eye.

Mr. Smith, of the Philadelphia and Erie, thought Mr. Setchel wrong in not running with the door open. Their practice was to put in a shovel of coal and then open the door a notch. By use of a deflector this injected a thin stream of air upon the fire which prevents smoke.

Mr. Gordon, of the P. W. and S. D. road, had just fitted up a set of head guides. Had no doubt but the guides would work well, having a strong crosshead and a good wearing surface, but the first cost was 50 per cent. more than the ordinary guides. He thought covering up the guides an advantage, but we get a good share of the dirt from below, and that part could not be closed up. Perhaps, however, it would be better to have the guides where the engineer could see them.

Mr. Barnett of the Grank Trunk, said it was an error to suppose that a large proportion of the engines built in England are domeless and take steam through a perforated pipe. As to cabs $\frac{1}{16}$" iron is as thick as they use with a wooden roof. It has been asserted that Joy's valve-gear is used in England on the Great Western and other lines. The Great Western has only one engine with that motion, and the London and Northwestern has it on two engines and ten are under construction.

Mr. Taylor, of the Old Colony, had experience with engines having the Jauriet water table, and he found it hard to keep tight, besides cinders accumulated between it and the flues, preventing the free making of steam. He changed the plan of the deflector and left an open space next to the flue-sheet with the best results. His engines so constructed steamed remarkably well, and he had no trouble with the deflector sheets burning out. But they had good water in his section of the country. He was afraid the water deflector would not work well with Western water.

Mr. Smith asked if the water deflector was more economical than the brick arch, and asserted that he got 10 per cent. economy from using the arch.

Mr. Taylor, in reply, said that the deflector gave fifteen feet extra heating surface, which he thought a good deal better for steam making than a chunk of brick. He admitted that the arch was economical, but with the deflector the hot gases have to travel further over a heating surface, so more of their heat is extracted by the water.

Mr. Sedgley, of the Lake Shore, asked if a saving of 10 per cent. by the brick arch was calculated from actual experiment, and on being answered in the affirmative, he assured the meeting that his own experience had been quite different. They had run engines with arches and without them, and their recorded tests showed that the arch effected no saving, so they abandoned its use. In regard to the use of a perforated pipe without a dome, he considered the thing impracticable with Western water. His experience had led him to favor a dome, and he asked where they got dry steam, near the water or away from it?

Mr. Smith, alluding to some remarkably economical performances of English engines, asserted that such a record would be impossible without the use of the brick arch.

Mr. Flynn, of the Western and Atlantic, had tried the brick arch and abandoned it, because he found no advantage in using it. Scientific men got up theories which they believed correct, when there was nothing in them. He preferred that practical minds should rely on their own opinions. That matter of perforated pipes had been tried twenty-five or thirty years ago, to his knowledge, and it did not answer. His best results had been got from engines with good wide wagon tops, where there was plenty of room for steam. In one case, where he altered an engine so that this steam room was increased, there resulted a remarkable improvement in the engine's steaming qualities. He considered that by taking away the dome we would abandon a valuable steam reservoir.

Mr. Smith said, when he first tried the brick arch his experience was similar to that of Mr. Flynn and Mr. Sedgley, for the engine burned more coal than it did before. At the front of the arch there was a bank of sparks, and he concluded at once that these sparks must be got rid of to give the arch a fair chance. So he experimented with the petticoat pipe till he got the draft to keep the arch clear, and then there was no more trouble, and the result was economy of fuel.

Mr. Lyne asserted that his own experience in riding on an engine equipped with the Joy valve-gear led him to the conclusion that the settling of the engine behind introduced serious inaccuracy of valve movement. In practice, the absence of increase of lead is found to be quite a disadvantage, for at high speeds the engine pounded badly, and the lead has been increased to $\frac{3}{8}$. This amount of lead is too great for slow speeds, and is a disadvantage in getting away from a station. This gear is in its infancy, and may be improved, but he thought it would be a long time before we got anything that will supersede the link. He considered that the adoption of a perforated pipe would be a retrograde movement. In regard to the proposal to strengthen rocker shafts and arms by substituting steel castings, he considered the proper course was to take the load off these parts by using balanced valves, improved lubrication and a better form of eccentric.

Mr. Setchel wanted to say in reply to Mr. Smith, that it was a very different matter running an engine with the door open on the road from what it was in a yard.

Mr. Smith assured the meeting that his engines were intensely hard worked and they made very few stoppages.

Mr. Taylor said the coal they used in the East causes a dense smoke just when it is put in the fire, and after a few revolutions it clears off. As they are very strict in Massachusetts about smoke, care to prevent it has to be taken in firing. The practice followed is, to open the door for a few revolutions after the coal is put in, and that prevents the making of smoke. We have to instruct our firemen, said he, to prevent black smoke, and as we get pretty intelligent men they succeed very well.

Notes of Mechanical Engineers' Cleveland Meeting.

BALANCED VERTICAL ENGINES.

W. F. Durfee read a paper with the above title, descriptive of an engine built by him some years since. The principal peculiarity of this engine was the use of a small piston, working in a cylinder situated immediately over the main cylinder, the small piston being attached to the main piston-rod, which was extended through the top cylinder head for the purpose. The small piston was of an area such that steam admitted underneath it, from the steam-pipe, would balance the weight of the main piston and its attachments.

Another feature of this engine was the placing of lantern brasses longitudinally in the center of the stuffing-boxes of the piston-rod and valve stem. These brasses were packed each side, thus leaving a space in the center of the packing, from which the condensed water was trapped off through a small pipe instead of following the rods down, which is frequently a troublesome feature in vertical engines. The slide valve of this engine was relieved by a packing ring on the back, working against the inside of the steam chest cover.

Mr. Durfee claimed that a vertical engine, properly balanced, was superior to a hori-

zontal engine in that it run with less friction, occupied less floor space, and required less in the way of foundation. He described the plan of placing the bed-plate of the engine on its foundation, which was by leveling it on pieces of iron so that there was at least one-quarter inch space between the under side of the bed-plate and the top of the foundation, and then, with the hold-down bolts in place, filling this space with cement grout.

In the discussion of this paper, Mr. Henning said he had never had success in grouting to the foundation in this way. He did not think ¼" space was sufficient to permit the grout to run satisfactorily.

Olin Scott had at different times had considerable experience in setting engines and other and heavier machinery by grouting to the foundation. In some instances he had set up a pipe 8 or 9 feet in height and filled the space under a pressure due to that head; with sufficient head the space would be filled or the bed-plate lifted.

W. J. Baldwin inquired if there was any trouble experienced in the operation of the balancing piston through change in the steam-pipe pressure.

Mr. Durfee said no trouble was experienced—the steam pressure, of course, being kept reasonably constant.

The President thought that in regard to vibration, whether in a horizontal or vertical engine, it was a question of the weight and strength of parts, including rigidity of foundation.

The opinion was expressed by others that a horizontal engine could be run at high speed quite as successfully as a vertical engine.

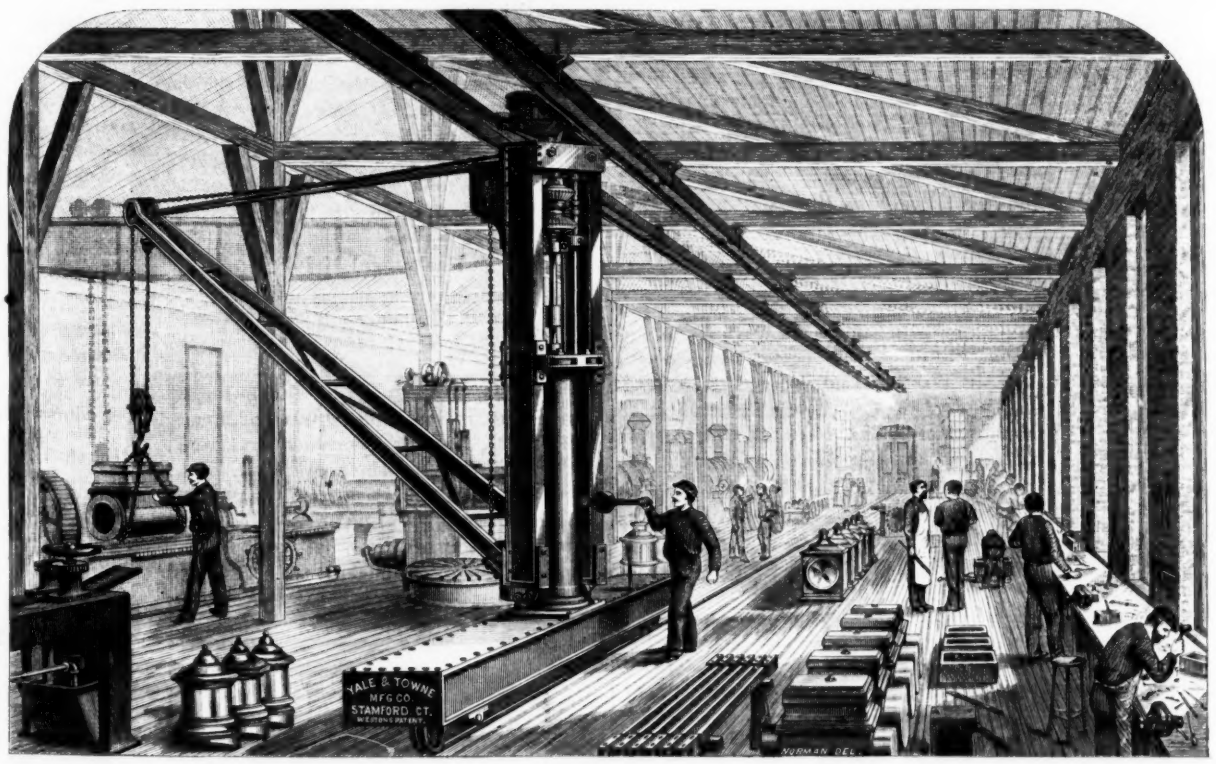
Prof. Sweet said their (Straight Line) engine was easily balanced, and their practice had been to balance the reciprocating parts according to the usually accepted theory as advanced by Porter, but that some recent experiments had a tendency to discredit the correctness of balancing in this way. Mr. Bullock had experimented with an 8"x14" Straight Line engine, running at 250 revolutions, which had been presumably correctly balanced, and obtained better results by placing a weight to counteract a part of the balance weight; he did not, however, find that this weight should be placed with or at the crank pin, but 15° behind it. It seemed to indicate to him that the element of time had to be considered in counter-balancing an engine, and that the matter was not yet thoroughly understood. Mr. Bullock had found in locating this additional weight for the best results that not only should the quantity but its position be changed with every change of speed.

Mr. Scott said he once set a horizontal engine on very soft ground, laying the foundation on piles. Upon starting the engine it shook the ground to a distance of several feet. He dug long trenches extending each way from the engine in the direction of its length and filled in with stone, which stopped the vibration.

New Walking Crane.

We illustrate herewith a crane which is in general use in England, but which thus far has not been as much used or appreciated in this country as its merits deserve. Indeed, the same remark will hold as to many desirable types of cranes, the immense economy and convenience of which, especially in shops handling heavy work, is only just beginning to be appreciated in this country. The crane referred to is known as a small walking crane, from its capacity of picking up a load at any point within its radius and of walking off with it to any other point along the whole length of the shop. As will be readily seen from an inspection of the engraving, it runs on a single rail on the floor, and is guided at the top by a carriage with rollers which run between two guide-beams which serve to direct the course of the crane and at the same time to prevent it from overturning.

Power is communicated to the crane by means of a continuously running rope which revolves a vertical shaft uninterruptedly in one direction. By means of proper clutches and levers power is taken from this shaft to operate the hoisting mechanism, which is situated at the top of the mast, and the traversing mechanism which is placed at the base. Hoisting or lowering is effected by means of mechanism which is operated through the lever at the side of mast, which the operator has hold of in the illustration. The lever which is shown standing up from the carriage is used for causing motion of the crane in either direction desired. It will thus be seen that the operations of the crane are extremely simple. The load being hooked on, the operator raises it to required height, and it is then swung around so as to clear the posts, and the crane is then set in motion by means of the other lever, and travels to any desired point, where the load is deposited.



NEW WALKING CRANE.

It is seen that this crane has the advantage over a jib crane in that it can pick up a load in any part of the shop and lay it down in any other; and, further, that the mast of this crane is not a permanent obstruction at any part of the floor, which very often makes a jib crane inconvenient. In shops where there are upright posts this crane has in some cases advantages over a traveling crane, because it can by means of its jib pick up a load outside of the line of the posts, which in many cases cannot be reached by a traveling crane.

The crane shown in the illustration was built by the Yale & Towne Manufacturing Company, of Stamford, Conn., for the Norfolk & Western Railroad Company for use in their shops at Roanoke, Va.

Railway Exposition Notes.

BY ANGUS SINCLAIR.

MISCELLANEOUS EXHIBITS.

The necessity for absorbing all the heat possible in its passage over the evaporating surfaces of boilers was indicated by various patent exhibits. Among these was the Coventry-Ford superheating locomotive boiler, which appeared only in the shape of a model, and a crude one at that; but the boiler possesses a principle which has been applied successfully to marine service, and it might probably be utilized in the interests of economy with locomotives. The boiler is of the return flue order, and is constructed of one shell, which is divided longitudinally a little above its center by a dividing plate that separates it into two compartments or chambers, through which are passed the flues. Those in the lower or water chamber make a connection between the fire box and smoke box at the head of the boiler, from whence the gases pass, by another set of flues, through the upper or steam chamber. There are grave mechanical difficulties in the way of carrying this into practice, but if they can be overcome, the boiler would produce good, economical results.

Searching through the Exposition brought one in contact with many old venerable ideas that had become rehabilitated and made to pass muster as the guiding spirit in new and so called original devices. A curious feature about some of these appliances is, how they come to receive endorsement from the Patent Office?

I examined two patent smoke consuming appliances, the leading merit of both being a steam jet which was used to inject a current of air upon the fire. This plan was patented by Kinnear Clark, the famous Scotch mechanical engineer, author of "Railway Machinery" and other works, forty years ago. He repeatedly made improvements in the details, and the patents have all run out.

I also examined a feed water heater which took steam from a hood-ended convey pipe placed in the exhaust pipe. I saw this plan of taking steam for heating feed water used 20 years ago on the English Southwestern Railway.

The invention was brought out by Beattie, a pioneer locomotive superintendent; but even with his fostering care the thing had to be abandoned as a nuisance, the work of keeping it up exceeding fourfold the saving effected.

There were many minor contrivances about the building that are useful improvements on small details of locomotives, cars and track work. Under this head I would class a very simple and effective bell-ringer, the invention of E. Lawson, of San Francisco.

The whole apparatus consists of a small cylinder 2½x8", the valve and piston working inside, while the ringing lever is attached without stuffing box or gland. Everything is closed up, and there is no leakage of steam or joints to keep in order.

Lloyd's self-packing valve is another annoyance saving device, the merits of which are likely to become appreciated by use. Any one who has had much to do with steam fittings knows the vexatious delays, the finger scalding and encouragement to profanity that often result from the packing of globe valve stems, and the whole genera of packed stems blowing out at the most inconvenient moment.

The Lloyd self-packing valve has a ground collar on the stem, which makes a tight joint inside the holding nut and obviates the need of packing.

In the portions of the country where hard or muddy water abounds, great saving to locomotive boilers results from the frequent blowing out of the mud that accumulates in the parts away from rapid water circulation.

To follow up the practice of blowing out regularly, a good cock that will close tightly is requisite. The ordinary plug cock is never tight, if used after the first month of its service. The consequence is, that mud drums are practically valueless, because engineers will not open cocks that will not close tight, but keep leaking over everything. A simple blow-off cock, shown at the Exposition, is constructed in a way that will cure this tendency to leak. The valve is something of the injector check pattern, with a stem through the bottom which raises the valve, and is rendered steam-tight when the valve returns to its seat. The inventor's name is Harrop. The cock is used on the Chicago and Northwestern Railroad, and is well spoken of.

Brake shoes are supposed to be an article of small importance in railroad service, but their maintenance in good order is a considerable expense They sometimes prove an expensive article in an indirect way, when one that is badly fastened drops off under a wheel and ditches a train. Very few parts of a car liable to derangement cause so much serious trouble as a brake shoe or beam that drops out of its place. Yet the subject has been very much neglected. Something like these were my reflections after examining an intensely simple brake head, exhibited by G. B. Simonds, of the Chicago and St. Louis Railroad. The shoe is held in place by a wedge, which is jammed close up by the hanger link. In putting on a shoe there is no bolt, nut, key or split pin needed Nothing but the wedge, which is easily got at, and it is impossible for any of the parts to get away unless the hanger link breaks.

Some of your readers may have seen and used cast-iron files, but to most people the idea of such a thing is novel; yet there was a good exhibit of cast-iron files at the Chicago Exposition, and what is more, there was ample proof that they did good practical work. Some of the best mechanical authorities in the country had used them—Rogers Locomotive Works, for instance—and they were spoken of with the highest terms of praise. There is some special process about their make which gives these cast-iron files surprising hardness and durability. Martin A. Howell, Jr., is the inventor and patentee.

"Is your railroad well equipped?"

Railroad President — Well equipped! I should say it was. Splendidly equipped, sir, splendidly. For instance, there are our first mortgage sevens, and our second mortgage sixes, and our equipment bonds, and our land-grant bonds, and our common stock, and our preferred stock, and the biggest floating debt of any road in the country. But that isn't all, sir. We've got the finest lobby that any corporation can show; a perfect daisy, sir. If you know of a road that's better equipped than ours is, name it, sir; name it, if you please.—*Boston Transcript.*

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NEW YORK, JULY 14, 1883.

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Master Mechanics' Convention at Chicago.

The meeting held in Chicago week before last brought a large accession of members to the Master Mechanics' Association, many of the new members coming from roads that had previously no representative. This is a direct advantage, as it strengthens the organization in respect to numbers, and widens its scope by bringing in the means of extended information regarding the mechanical work of railroads that had held aloof from the society. Many of the new members came from the South and Southwest, and their connection with the association is likely to be highly beneficial to themselves, to the roads they represent, and to the sections of the country they come from.

While the members of the association seemed desirous enough to push along the work for which they came together, there were too many attractions connected with the Exposition to admit of the close attention to business that might have been desired. The papers read were unusually long, and withal interesting and instructive; but, as a rule, they did not receive so much discussion as was desirable. For instance, one of the most important subjects for investigation was "The most practicable and best system of paying premiums to engineers and firemen, to induce economy in working locomotives." Mr. Wilder gave in an excellent report, and the matter has been under consideration for two years, yet it was passed without a word of discussion. This was not because there was no diversity of opinion upon the subject, or that the report covered the whole matter, but because the business outside claimed the attention of the members. This is a subject hard to deal with, and the views of the individual members would have been valuable, especially as the carrying out of the recommendations of the report depends entirely upon the inclinations of the various master mechanics. On some roads it would be impracticable to carry into effect the system that Mr. Wilder describes; and the experience of the members might have suggested modifications of the plan adapted to their various wants. The discussions on boilers and on smoke stacks were curtailed through want of time, and that on other subjects was omitted for the same cause.

When the association meets next year at Long Branch, it is to be hoped that the business will be so arranged that full and ample time will be provided for the discussion of each subject.

On looking over the various Master Mechanics' convention reports, it is obvious that many of the most valuable and interesting points of information regarding subjects have been brought out in the course of debates. Members will often freely relate their experience respecting methods and material while the subject is up for discussion, when they would never think of writing their sentiments and sending them in to the committee of investigation. This impromptu information possesses especial value, and every care should be taken to let the association have as much of it as possible. It will be an unfortunate day for the association when they allow the reading of papers by technical specialists to crowd out the practical knowledge that can be gleaned from an exhaustive debate.

The month of June, just past, was notable for conventions of engineers' national societies. June 4th, the American Institute of Mining Engineers met at Roanoke, Va.; June 12th, the American Society of Mechanical Engineers met at Cleveland, and the Master Car Builders' Association at Chicago; June 19th, the Railway Master Mechanics' Association met at Chicago, and the American Society of Civil Engineers at St Paul. These meetings caused the bringing out of a great deal of valuable engineering literature. Besides the conventions, the great Railroad Exposition at Chicago, which closed June 23d, attracted hosts of people interested in railroad engineering. In view of these gatherings it is safe to say that June 1883, marked some important advances in engineering knowledge.

Improvements in Bombshells.

During the last twenty years wonderful improvements have been made in strengthening articles of mechanical construction; especially such as are required to undergo great strains, and where safety is a leading element. These improvements have been applied not only to the peaceful arts but also to the art of war. To some extent the United States Government, (although slow in most matters of importance) has recognized mechanical improvements that are applicable to military affairs. We find an item in several of our exchanges this week which goes to show that the War Department at Washington is determined to keep abreast of the mechanical progress of the day. The item is as follows:

The Cambria Iron Company, of Johnstown, has received the contract for steel bombshells for the United States Government, which are to have a tensile strength of 90,000 pounds.

We have long thought that improvements should be made in the strength of bombs. During the "late unpleasantness" we had some active experience in dodging (by keeping close to the ground) the whizzing pieces of iron bombshells sent from the guns of the enemy, who were very poorly supplied with metal having a high tensile strength from which to cast them. The consequence was many men were badly hurt by the scattered pieces from fragile shells. As the prime object of bombshells is to scare and not to hurt, they are now to be made of tough steel and therefore will be less likely to explode, and when they do explode will fly into fewer pieces. The additional safety secured by this improvement will be obvious to everybody looking into the subject.

A Mechanical Halo.

Most of our readers are probably aware that the great Corliss engine, which ran the machinery at the Centennial Exhibition at Philadelphia, was bought by the Pullman Car Company, and is now in their great works near Chicago. The power is received on the main driving shaft by means of a geared wheel, which is situated in a semi-dark cellar beneath the engine room. When viewed at right-angles to its motion, the geared part shines in the dark with a glossy brilliancy, and stands out from the solid wheel like a halo round the head of a saint.

Different Kinds of Industrial Education.

In a speculative way, at least, the popular idea of an industrial education is that of one to be obtained at schools which aim to properly regulate the education of both mind and muscle. Undoubtedly the ideal industrial education, the one most likely to benefit its possessor, combines with practice a good deal of the knowledge of the practice and researches of others.

It is probably equally true that to be the most effective the practice and what is usually called the theory should be blended rather than be come at separately by a sort of cramming process, first with one and then with the other. By the latter process the full advantages of neither are obtained, because one of the most important considerations is that the knowledge gained in one direction shall, in passing, show the needs of the other.

The technical or industrial school can without difficulty attend to the theoretical part by furnishing so far as is known correct instruction, but there is no less need—rather there is much greater need—that the practical part shall be correct, and just here is where any system of industrial education in schools is quite likely to be wrong.

In other words, the practical part of the education of such schools may not unreasonably be supposed defective in one of its most important elements, viz: *lack of purpose*, or the setting up of incomplete purposes.

In the trades to which such an education leads up materials are worked to a purpose, and those who work them, whether in the capacity of proprietors or workmen, do so in direct competition with others similarly engaged; hence the practical part of an industrial education should embrace working to a definite end, which is materially more than completing a task. Physicians tell us that needed exercise fails in its purpose when aimlessly pursued. So to a great extent will any system that aims to impart practical instruction through doing something for the mere sake of doing it.

There is not much room for the man who does, even well, in a week what another does in a day, and industrial education to be of substantial value must at the *same time* it teaches how to do a thing teach how to do it so as to *pay*. Unless it does this it is established on a wrong basis, and creates impressions and confirms habits never likely to be got rid of. While this may not be impossible in industrial schools, it is undoubtedly the most difficult problem connected with their successful working.

One of the advantages, so far, that those have who contrive to educate—in the commonly accepted sense of the term—themselves while pursuing their regular work, is that the practical part of their education has the element of completeness, and is blended in the most satisfactory way with the theoretical.

Education under these circumstances may not be so easy of accomplishment, but it never need lack in the way of comparative utility.

An intelligent mechanic related recently an experience which seems so exactly to the point of working with a definite purpose as to be worth preserving. Being desirous of learning mechanical drawing with especial reference to his business—that of a foundry foreman—he applied to a professional teacher from whom he received instruction for about two years. At the end of that time he knew, as he expressed it, just as much about making any practical use of his knowledge of drawing lines as he did in the beginning. Despairing of accomplishing anything he discontinued his lessons, but fortunately happened to mention his lack of success to an acquaintance who volunteered to assist him. His instructions were to make any sort of a rough sketch of some mould being made in the foundry—something he had some distinct reason for making a drawing of—which should be sufficient by the aid of his memory to fix the dimensions. This he did, and by repeating it was in a few weeks, and with very slight assistance from his friend able to do all he had ever expected, and what two years' hard study had left him as much in the dark about as ever.

The reasons that lead to honest differences of opinion about the value of mechanical appliances were well illustrated in a small discussion that took place in the recent Master Mechanics' convention. Several members in speaking of the brick arch in the fire-box gave their opinions freely against its use, saying it effected no saving of fuel. A member who favored the arch told that his first experience had been similar to the others, for cinders accumulated on top of the arch and closed up the flues, which caused a decided loss of heat. He did not abandon the thing at this point, however, as the others, had done, but went on experimenting till he found means of keeping the arch clear of impediments to draft. Then it was a success in every way, and his road could not afford to run their locomotives without the brick arch, or a substitute.

A Lewiston, Me., paper publishes a cock-and-bull story about the low cost of water-power in that city, which is put at only $5 a horse-power per annum. Steam-power is declared to cost just *ten times more* than water-power.

It mentions a mill using 1,700 horse-power running by water, and gravely informs its readers that if they used steam (the Corliss engine being mentioned) their power would cost them $85,000 a year. The fact is their power ought not to cost one-half of that amount, with Corliss engines or any other good, economical steam engines. If the people of Lewiston wish to extend their manufactures by inducing new industrial establishments to locate there, their most necessary

preliminary action would seem to be to repress the excessive imagination of local newspaper writers.

Nothing is gained, and much is lost to the industrial reputation of a town, by making such ridiculous assertions in local newspapers.

One of our readers, in the Goss Marine Iron Works, Bath, Me., writes us as follows:

"Chordal says in a recent letter that he means to watch the behavior of a new English lathe, and describes the fits. There is just such a lathe here as he describes, started a few days ago, and run by another 'fine-haired' mechanic. The talent of the shop was all utilized in the job of adjusting the machine, and in selecting nuts for a fine job of face-plate work upon it—pistons and followers—and now the said 'fine haired' is spending more time in scraping down than he did in turning up the work. The thing will certainly turn up a good deal of work, but—*cui bono?*"

A Machinist Promoted.

The new management of the Rome, Watertown and Ogdensburg Railroad have appointed H. M. Britton general manager of the road, with headquarters at Oswego, N. Y. Mr. Britton is a self-made man, having begun his career as a machinist, graduating as a master mechanic and engineer. The quality of his work in reorganizing and equipping the mechanical departments of the Midland Railroad, promises well for like efficiency and skill in bringing the Rome, Watertown and Ogdensburg road up to its former state of mechanical and financial success.

Literary Notes.

The National Car Builder for June is, as usual, replete with interesting matter for railroad men. An illustrated article on "How to Manage Wrecked Trains" ought to be studied in every railroad office. Several fine engravings, showing new locomotives, new passenger cars (with details), and car fixtures, add to the attractiveness and value of the number. Portraits and biographical sketches of the late Howard Fry and the late Alpheus Gleason still further add to its interest for the reader. The directory of the railroads of the United States and Canada, showing the gauge, length of road, number of locomotives, and number of cars, together with the names and titles of their principal officers in charge of the operating, purchasing, and rolling stock departments, is carefully corrected with each issue. *The National Car Builder* is published monthly by R. M. Van Arsdale, 140 Nassau street, New York, at the low price of $1 a year, and should be in the hands of every man directly interested in operating railroads.

The National Car Builder Supplement and Export Edition for 1883 is also before us. It contains 112 pages, neatly printed, and presenting a host of engravings of cars, locomotives, tools, machinery, and appliances used on railroads. It gives full directories of car builders, car axle manufacturers, car spring manufacturers, and locomotive builders, all in the United States and Canada, also all rail mills in the United States. Its directory of street railroads of all parts of the world is the most complete we have ever seen, giving, as it does in most cases, the length of the road, its gauge, weight of rail, and number of cars and horses, as well as names of officers.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(236) M. R., Freemansburg, Pa., asks: How can I bronze small castings? *A.*—See answer to question 182, issue of May 19, 1881.

(237) W. C. F., San Francisco, Cal., asks: What is used to lacquer small articles after they are plated with gold and copper? *A.*—Gold plating does not require lacquering. See answer to question 172, May 12, 1883.

(238) F. F., De Soto, Mo, asks: What causes the groaning noise sometimes heard in the Westinghouse air brake pump? *A.*—We attribute the defect of groaning to either of two causes, viz., badly fitted rings or deficiency of oil. That has been our own experience of the matter. If any reader can give other causes for the groaning we will be pleased to hear from him.

(239) H. A. S., Charlotte, Maine, asks: 1. How much dry hard wood will be required to get up steam and run a 5-horse power engine to its full capacity for 10 hours? *A.*—This will depend upon the kind of engine and boiler. Perhaps ⅓ cord. 2. How much more steam will be required to run a 5-horse power engine doing 1-horse power work than to do the same work with a 1-horse power engine? *A.*—Under equally favorable conditions probably about 20 per cent. more.

(240) H. A., Gloversville, N. Y., writes: I am about to furnish steam for heating water in a laundry 150 feet from the boiler, and wish to know whether to run the pipe overhead or underground; also what is the best covering for the pipe? *A.*—If the pipe is under the cover of buildings there will be but little difference in the loss of heat whether it is under ground or above ground. If exposed to the atmosphere the loss would be less, especially in cold weather, if the pipe were properly laid under ground. There are several materials that are valuable for covering pipe, the best perhaps being mineral wool and asbestos.

(241) J. P., Boston, Mass., writes: I have an engine with 12" pulley running at 250 revolutions per minute, with which I wish to drive a line shaft and from this shaft drive three machines, each of which will require about one-horse power. These machines each have a 9" pulley with a 3½" face. What I want to know is whether to run the line shaft 100 revolutions and belt to the machines from 22" pulleys, or to run the line shaft 250 revolutions and belt from 9" pulleys to the machines; or whether and why some other speed would be better? *A.*—So far as we can judge without knowing more of the circumstances, we should be inclined to say, run the line shaft at about 175 revolutions. The objections to running the shaft at 250 revolutions would be the difference in diameter between the driving and the driven pulleys for the machines. One objection to 100 revolutions for the line shaft would be the difference in diameter of the pulley on engine and the main pulley on line shaft; another that the size of line shaft and pulleys would be needlessly large. By adopting a speed of line shaft between these extremes none of the conditions would be at their worst. There may be considerations not stated that should control the speed of line shaft.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

James W. See, Consulting Engineer, Hamilton, O.

A. Wilkinson, expert steam engineer, Manayunk, Philadelphia, Pa.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, 25" lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

How to reach 40,000 prominent "*Steam Users*" in the United States. Send for our circular. The J. N. Mills Publishing Co., 145 Broadway, N. Y.

New tool chest, price $10. See description in AM. MACHINIST, April 14th, or send for circular. Goodnow & Wightman, 176 Wash'ton st, Boston, Mass.

Castings furnished for 18" and 21" swing engine lathes. Gearing turned and cut if desired. C. F. Batt, Phœnixville, Pa.

Currier & Snyder, Worcester, Mass., manufacturers of improved labor-saving uprigl. drills, 24" and 26". A specialty circular and price on application.

Speed and drill lathes, 10"x4', new design. Self-clamping rest, first-class material and work. Parties about to buy will do well to inquire. C. Wing, Greenfield, Mass.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery. By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

Business men furnished stenographers, who are machine operators, without charge for my services. Shorthand taught by mail. Caligraphs sold; special inducements offered; correspondence solicited. W. G. Chaffee, Oswego, N. Y.

The National Feed-Water Heater—the best and cheapest in the market; warranted to heat water by exhaust steam up to 206° to 212° Fahrenheit. This heater commends itself to every practical man. For description and prices, apply to the National Pipe-Bending Company, New Haven, Ct.

We will pay 25 cents each for copies of the issue of January 21, 1882, that are in good condition. Those kind enough to forward us copies of the above date will please write name and address on the wrapper for identification. AM. MACHINIST Publishing Company, 96 Fulton Street, N. Y. City.

Cheapest, strongest, most simple, compact, durable, effective and economical steam pump in the market. See list of prices in this column next issue. No machinery, no oil, no special care. Can be worked suspended by a chain. Pulsometer Steam Pump Co., 83 John street, New York.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

For a strictly first-class automatic engine, from 10 to 60 horse-power apply to the Straight Line Engine Company, Syracuse, N. Y.; medium or high-speed; perfect balance; fewest parts and fewest working joints; uniform speed at all ranges of power or steam pressure; the best material and workmanship in all vital parts; the most correct distribution of iron; unexcelled in smooth running.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

MANUFACTURES.

The Paterson Locomotive Shops have orders for upward of 300 engines ahead.

A cotton-seed oil mill and a $25,000 factory are to be erected at Albany, Ga., this summer.

A large iron furnace is among the enterprises contemplated by Tyrone (Pa.) capitalists.

Additional machinery is to be put in the Randolph (Ala.) factory. The enterprise is prospering.

The Ætna Machine Works, of Warren, O., are building a foundry and wood shop 50x100, one story.

The Zylonite Comb and Brush Company are erecting a building 154x37 feet, two stories, at Adams, Mass.

John W. Fleck, 201 Centre street, New York, has just put in a 30-horse power boiler, fed by a Korting injector.

The Morse Bridge Works at Youngstown, Ohio, are working full time, day and night, to keep up with their orders.

The Amoskeag Mills, Manchester, 'N. H., are to erect a new chimney 250 feet high, and 25 feet diameter at the base.

The site of the new cotton factory at Cedartown, Ga., will embrace twenty acres, and work on the building has begun.

The Lowell (Mass.) Manufacturing Company are putting in a pair of 20x30 Hartford engines to develop 500-horse power.

Work will begin in a few days on the new Panhandle locomotive shops at Columbus, Ohio, to cost between $800,000 and $900,000.

The work of excavating for the foundations for the machine shops of the P. V. & C. R. R., on Twenty-fourth Street, Pittsburgh, Pa., is progressing rapidly.

The large sewing machine factory at Downingtown, Chester Co., Pa., has been bought by Philadelphia parties, and is to be converted into extensive stove works.

It has been decided to abandon the project of establishing at Utica, N. Y., a needle factory under the patents of Fontaine, the locomotive man, for the present, at least.

The machine shop for the new watch factory to be erected at Aurora, Ill., will be built at once. The plans for the new cotton mill have been made. The main building will be 100x26 feet.

Cleveland grindstone manufacturers report trade good. They say that prices are maintained, and the volume of business is equal to, if not better than, last year.—*Cleveland Trade Review.*

English textile machinery is arriving at Fall River, some 23 cases already having been opened: one case for the King Philip Mills, nine for the Flint Mills, and thirteen for the Merchants Mills.

The Hendey Machine Co., Torrington, Conn., write us: "Our business is very fair, and seems to be improving, and we have every reason to think the average for the year will be good."

The Russell Hardware Company, with Charles T. Russell as President and $150,000 capital, is going into business at Higganum, Conn. It will employ 50 to 75 men, and controls a number of valuable patents.

The silk manufacturing industry of Paterson, N. J., is reported as quite dull. The reason for the dullness is not very clear, as ladies are wearing silk dresses more than ever before, and silk importations are not increasing.

The Bristol Manufacturing Company will ask for incorporation from the New Hampshire legislature with an authorized capital of $200,000. They expect to erect a four-set stocking mill at Bristol, on the Beckford water power.

The Denver *Journal of Commerce* says: As fine a grindstone as is produced in the United States is made at Trinidad in this State. Strange as it may seem, there are but few places in the country where good stone for grinding purposes can be had.

The New Home Sewing Machine Company of Orange, Mass., is removing the old building between the foundry and the river, and in its place will erect a handsome brick building for improved mechanical appliances, to be used in connection with the new foundry.

The Deane Steam Pump Company, Holyoke, Mass., have moved their Philadelphia office and warerooms from 43 South Fourth street to 49 North Seventh street, where they will carry a full line of their steam pumping machinery in charge of a representative of the company.

Tracy, Kingman & Co., of Chicago, are putting additional machinery in their works, and are also increasing their working force. An improved machine for cutting off the ends of boiler tubes without removing them from the boiler will soon be put upon the market by this firm.—*Industrial World.*

There is a general revival of business at the Jones car works, West Troy, N. Y. A large building has been erected for building cars, and another for a paint shop. The capacity has been doubled in many departments, and night work has been commenced in the blacksmith shop. About 100 operatives are employed.

The property of the Greenfield (Mass.) Tool Works was sold for $23,000—a low figure. Among the purchasers are C. H. McClellan, Chas. Tilton, and F. G. Tilton, merchants of that village. The new company has $50,000 capital stock, much of which has been placed It is intimated that the Co-operative Cutlery Company's works will be absorbed by the new company.

The *Baltimore Manufacturers' Gazette* of June 23 says: "The manufacturers of this city, especially those making machinery, are well crowded with orders. Within the month past there has been a decided improvement in this particular, and establishments where business was reported dull six or seven weeks ago are now running a full complement of hands, and find plenty for all to do.

The *Lewiston Journal* says: There is a prospect that important manufacturing enterprises will be inaugurated in eastern Maine. Oldtown, which has a fine water-power, has voted to exempt manufacturers who may build mills there from taxation for a term of ten years, and it is stated that capitalists are now ready to build a $600,000 cotton mill, if they succeed in purchasing the property they want.

The directors of the new Matthews Cotton Factory at Selma, Ala., are going to increase the number of spindles from 4,600 to 10,000. The officers of the mill were authorized to make contracts for the erection of a building as large as the present one, and also to purchase the spindles and machinery. The size and the capacity of the present mill will be more than doubled by this procedure. Immediate steps will be taken in this movement.

The firm of Henry R. Worthington, 86 and 88 Liberty street, New York, has established an additional branch office and warehouse for the West and Northwest at 95 Lake street, Chicago, Ill. They propose to carry in stock there at all times a full line of the regular sizes of Worthington steam pumps and water meters, and such special sizes as may be needed in emergency for important service, as well as a general supply of parts for repairs.

Broad & Ewer, Progressive Iron Works, are getting well established in their new shops, 251 to 255 Greenpoint Avenue, Brooklyn, N. Y. They are at present building six of the Parson & Northey grinder and amalgator for precious ores, each of which is to be complete, with steam engine for driving. This company also manufacture the Van Dyke water tube boiler, to be illustrated in next issue of the AMERICAN MACHINIST, as well as do a general machine business, devoting attention to perfecting and manufacturing new devices of merit. Their new shops are pleasantly located, with ample room for future enlargement.

The Marshall Foundry and Machine Company, Marshall, Tex., are preparing to erect a new wheel foundry and other buildings. The wheel foundry will be 75 feet wide and 115 feet long. The walls will be 20 feet high, with a lantern roof 40 feet above grade. The new foundry will enable the company to increase its present capacity of 10,000 per annum to over 40,000. The company are far behind their orders, but hope to have their new buildings in working condition very soon, when it will be in shape for any reasonable amount of new work. The company have just finished a liberal order for stock and coal cars for the I. & G. N. road, and are now working on an order for coal cars, or gondolas, for the Texas and Pacific company.

Machinists' Supplies and Iron.

NEW YORK, June 28, 1883.

Pig iron is selling on the Iron and Metal Exchange at $21 spot, and $21.75 to $22 50 for No 1, for September and October delivery. Demand is restricted to immediate wants. No. 2 sells at $18.50 to $19, Coltness at $24.50; Eglinton, $21; Carnbroe at $22, and Glengarnock at $22 50. Steel rails are dull at $38 at mill, but orders are booked to a large amount. Wrought scrap, $24 at yard; Ingot copper 15¾c., for lake and 14¼c. for Baltimore; pig lead 4¼c.; Spelter, 4.70 for domestic common, and 8c. to 8¾c for refined; pig tin, 22c. for Banca, 21¼c. for Billiton, 21¾c. for Australian, and 21¾c, for L. & F. Antimony sells at 9¾c. for Hallet's, and 10¾c. for Cookson's.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—A first-class pattern maker. Address J. H. & D. S. McEwen, Wellsboro, Pa.

Wanted—A good moulder. Address Eureka Foundry, Eureka, Nevada.

Wanted, Tool Maker—A good workman can find permanent employment. Joel Hayden Brass Company, Lorain, O.

Wanted—A first-class mechanical engineer and draughtsman; one who has experience in the construction of automatic engines. Address, with references, P. O. box 175, Richmond, Va.

Wanted—A situation as foreman of a foundry. Have had 35 years' experience. Machinery and general jobbing preferred. Can give best of references. Address J. S., care AM MACHINIST.

Machinist and engineer wishes a position in an extensive plant of electric lighting on Brush system. Can repair and adjust lamps and machines, lay down lines, if required, and make all necessary equipments. Address T. W. Gibson, Pittsburgh, Pa.

Wanted—By a thorough tool maker and machinist, a situation in Philadelphia. Eighteen years' recommendations of former employers. Satisfaction guaranteed. Address, with terms, Box 10, AM. MACHINIST, 96 Fulton Street, N. Y.

Situation wanted by a thorough machinist and tool maker and designer of special tools and machinery, to take charge of machine shop and foundry: thorough on interchangeable system and modern machine shop practice. Address Hall, 705 Summit avenue, Jersey City, N. J.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.

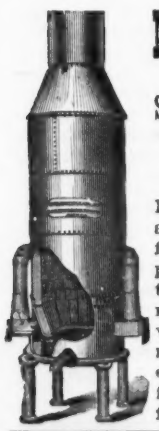
Wanted—Catalogues and price-lists of good mechanic and boiler-makers' tools. Critchley & Whalley, Portsmouth, N. H.

$3,000 to $5,000.—A machinist and engineer would loan the above amount, or invest as part capital in a machine or boiler shop where he would receive fair compensation for his services. Address C. D., AM. MACHINIST.

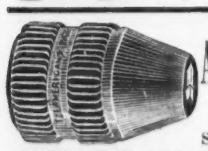
For Sale, an Unusual Opportunity—Machine and blacksmith shop, with large foundry, tools, and patterns; having large run of custom work, as well as contract work in foundry. Located two blocks from depot. Railroad side track on shop grounds. For information, call on or address William Fidler, 171 Eighth avenue, Topeka, Kansas.

Double-Acting Gas Motor.—The undersigned wishes to deliver the patent right of the above-named motor, and he will therefore begin a transaction with manufacturers. This motor acts in the following way: Atmospheric air compresses alternately upon both sides of the piston, as in steam engines. This motor can act backward or forward, and can be put in every horse-power. It can be used stationary, or movable for locomotives on railroads, for street cars, or for navigating purposes. For further information apply to Wm. Hamerschmidt, 909 Callowhill St., Philadelphia, Pa.

THE
MACKENZIE CUPOLA
MADE BY
SMITH & SAYRE MFG. CO.,
245 Broadway,
NEW YORK.

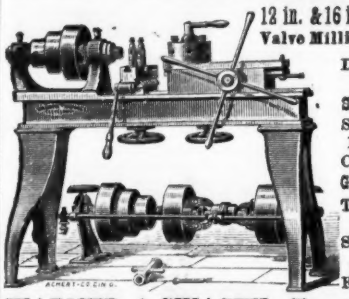


Differs from all others in having a continuous tuyere. Blast enters fuel at all points, causing complete diffusion of air, and uniform temperature throughout the furnace. Melts 10 to 15 tons an hour with blast pressure required to melt 2 or 3 tons in an ordinary cupola. Gains largely in time, fuel and quality of casting. Send for prices of **Cupolas** and **Blowers.**



THE
American Drill Chuck
Is the cheapest 3-parallel Jaw Chuck. Price, $4.
Sold by all Tool Dealers.
BREHMER BROS., 440 North 12th Street, Philadelphia, Pa.

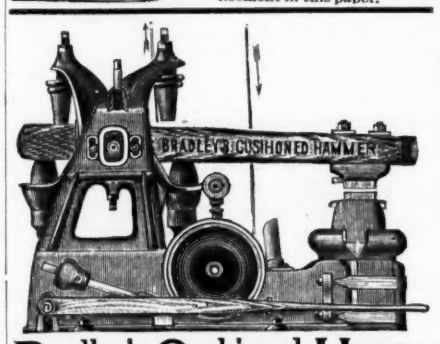
BRASS WORKING MACHINERY.



12 in. & 16 in. Monitors
Valve Milling Mach's
Double Key Lathes,
Speed Lathes
Slide Rests
Revolving Chucks for Globe Valves,
Two-Jawed Chucks,
Small Tools and Fixtures.
WARNER & SWASEY, Cleveland, O.

COOKE & CO., DEALER IN

Machinery & Supplies,
22 CORTLANDT ST.,
NEW YORK.
AGENTS FOR THE
Greenfield Vertical Engines
2½ to 30 Horse Power.
Unequaled in workmanship and quality of material. Prices lower than any other first-class engine.
ALSO
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

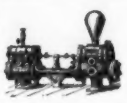


Bradley's Cushioned Hammer
Stands to-day WITHOUT AN EQUAL.
OVER 800 IN USE.
BRADLEY & CO., Syracuse, N. Y.
ESTABLISHED IN 1832.

BOSTON BLOWER CO.,
BOSTON, MASS.
Blowers and Exhausters
OF EVERY DESCRIPTION.

Superior 10, 12 & 16 in.
SPEED LATHES.
Built by FAY & SCOTT,
DEXTER, MAINE.
Send for Description.

JOSIAH MACY'S SONS,
189 & 191 FRONT ST., NEW YORK.
Oil Manufacturers,
We make a specialty of compounding oils for high-speed engines and all purposes not in the ordinary line of machinery.
Samples Submitted Free. Established 1822.



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HOLYOKE, MASS.
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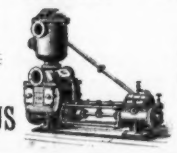
92 & 94 Liberty St. NEW YORK. | 54 Oliver St. BOSTON. | 49 N. 7th St. PHILA. | 226 & 228 Lake St. CHICAGO. | 620 & 622 N. Main St. ST. LOUIS.
MANUFACTURE
STEAM PUMPING MACHINERY
For Every Possible Duty.



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CONDENSING APPARATUS
A SPECIALTY.

UNION STONE COMPANY,
Patentees and Manufacturers
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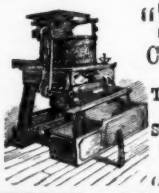
UNION EMERY WHEEL.
EMERY, EMERY WHEEL MACHINERY AND TOOLS A SPECIALTY.
Automatic Knife Grinding Machines, Wood Polishing Wheels, Grinders' and Polishers' Supplies.
Catalogues on application. 38 AND 40 HAWLEY STREET, BOSTON, MASS.

THE
M. T. Davidson Improved Steam Pump,
MANUFACTURED BY
DAVIDSON STEAM PUMP CO.,
OFFICE AND WORKS,
41 to 47 KEAP ST., BROOKLYN, N. Y.
Warranted the Best Pump made for all situations.
KELLY & LUDWIG, AGENTS,
49 and 51 North Seventh Street, Philadelphia

BOOKS —RELATING TO— Steam Engines, Machinery, Heat, Gas, Electricity, Casting and Founding, &c.
DESCRIPTIVE CATALOGUE, 100 PAGES, 1883, SENT FREE ON APPLICATION.
E. & F. N. SPON, 35 Murray St., N. Y.



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Corn-Mills and Millstones,
ALL SIZES.
THE BEST IN THE WORLD
FOR TABLE MEAL!
Samples of Meal Sent on Application.
NORTH CAROLINA MILLSTONE CO.
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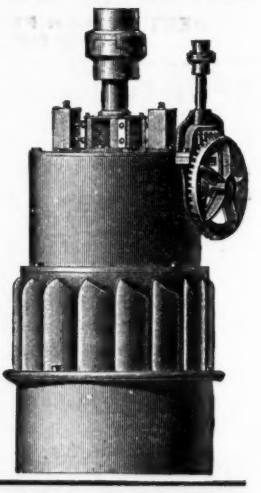
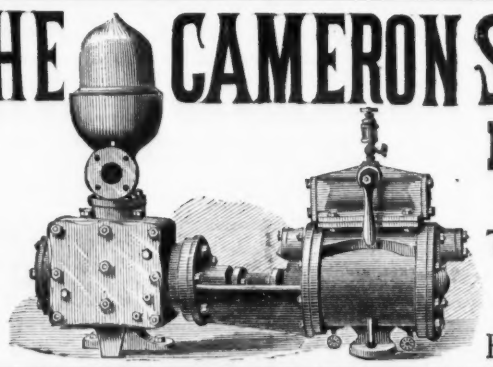
(Please Mention this Paper.)

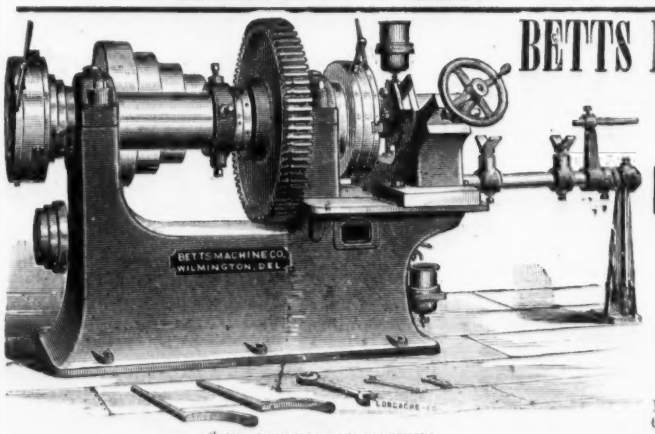
THE HERCULES TURBINE
Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.
—BUILT BY—
THE HOLYOKE MACHINE CO.
SHOPS AT
Holyoke and Worcester, Mass.
Send for Catalogue, Circulars and Price List to either of the above places.



THE CAMERON STEAM PUMP.



Is the Standard of Excellence
AT HOME AND ABROAD.
THE A. S. CAMERON
Steam Pump Works,
Foot of East 23d St., NEW YORK.



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BETTS MACHINE CO.
Wilmington, Del.,
MAKERS OF
MACHINE TOOLS
FROM
Improved Patterns.
Three sizes of Cutting-Off Machines: 2½ in., 4 in., and 6 in.

REMOVAL.
GEO. F. BLAKE MANUF'G CO.
HAVE REMOVED TO THEIR NEW QUARTERS,
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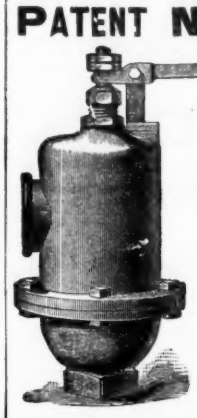

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NEW YORK AND GLASGOW.

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Our experience in Safety Valves has been a varied one, extending over 15 years, during which time we have tried nearly every valve placed on the market just long enough to become thoroughly disgusted with the working of each and every one of them. We learned all their faults and what to avoid. With this experience in our favor, we have designed quite a number of valves, which we hoped would overcome the difficulties we had met, but since trying the Consolidated Safety Valve Co.'s NICKEL-SEATED "POP" SAFETY VALVE, we have come to the conclusion that we can make more money selling boilers than we can in designing safety valves.

In 1882, we *bought over 300 of your 3", 3½" and 4-inch valves and still have the first complaint to make in regard to them*, and though costing us nearly *one hundred per cent. more than the best competing valve*, we consider it money well spent to adopt it for use *on all our work*. Expecting soon to send you further orders, we are, very truly yours,

THE BABCOCK & WILCOX CO.
NAT. W. PRATT, TREAS.

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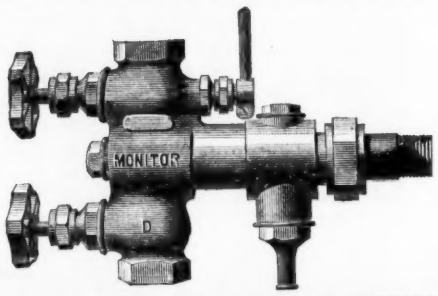

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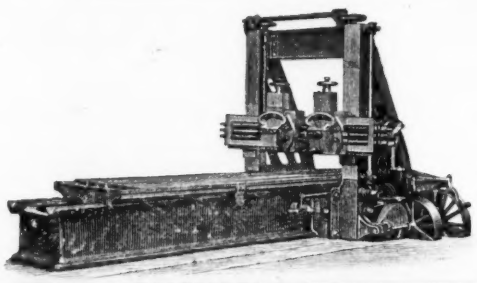

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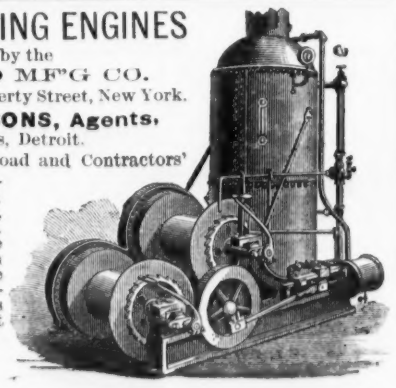

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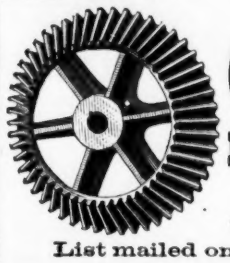

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With Steel Screws. Lathe Mode and Hardened.

This dog is very heavy, and is warranted not to break with any work

No. 1	3-8 in		$ .50
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" 3	5-8 "		.70
" 4	3-4 "		.70
" 5	7-8 "		.80
" 6	1 "		.80
" 7	1 1-8 "		.95
" 8	1 1-4 "		.95
" 9	1 3-8 "		1.10
" 10	1 1-2 "		1.10
" 11	1 3-4 "		1.25
" 12	2 "		1.40
" 13	2 1-4 "		1.60
" 14	2 1-2 "		1.60
" 15	3 "		1.80
" 16	3 1-2 "		2.00
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" 19	5 "		3.50
Full set, 19 Dogs,			26.35
No. 20	5 1-2 in		4.25
" 21	6 "		5.00

When ordering, state as above, whether a full set or a set of 13 or smallest of 8. Users of these dogs prefer them to any other make.

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" 6	1 "		.80
" 8	1 1-4 "		.95
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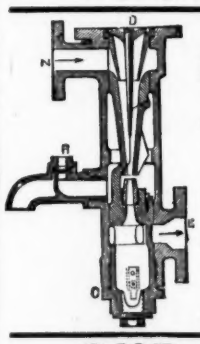
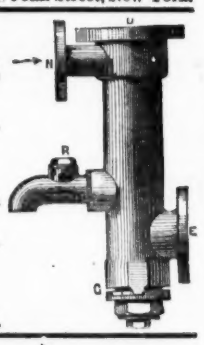


NEW INJECTOR



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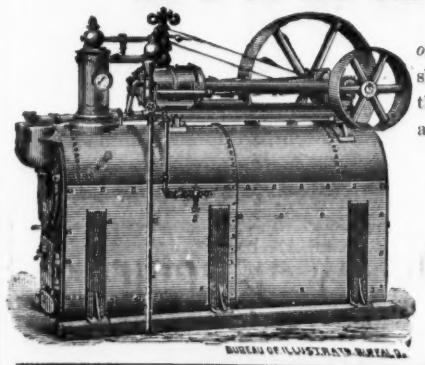

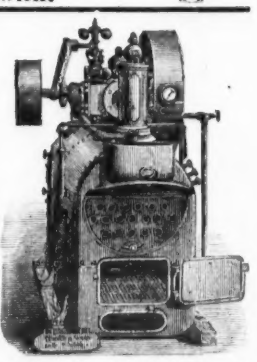

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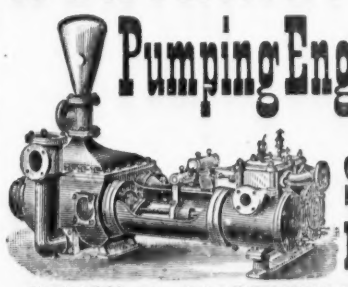

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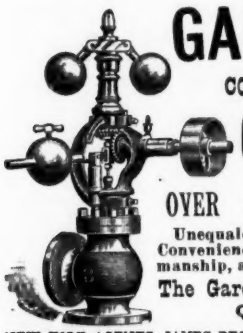

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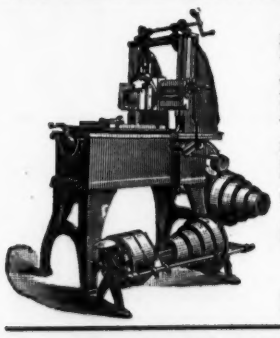

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Also, quick return motion and screw running whole length under bed.

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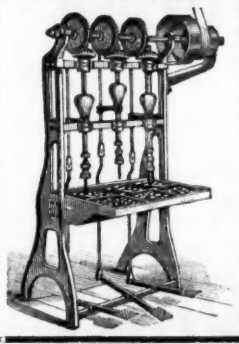

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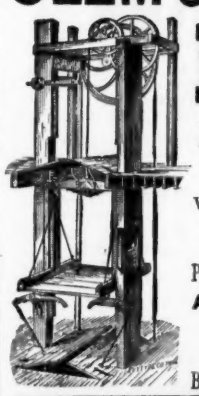

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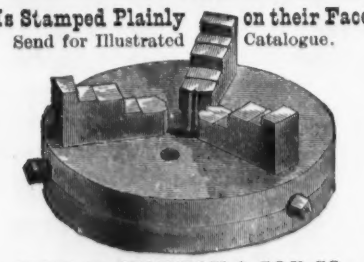

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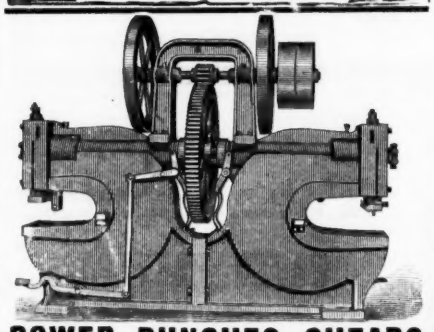

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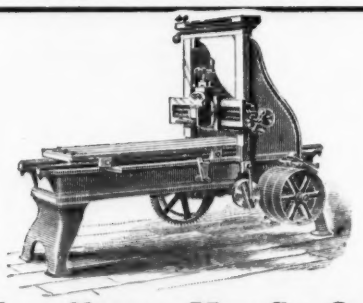

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Adapted to rapid work with small drills. Its extreme sensitiveness prevents clogging and breakage of drills. Has a swinging table with attachment for center drilling. Instantly adjustable to different lengths of work. Over 200 already in use. Send for circular.

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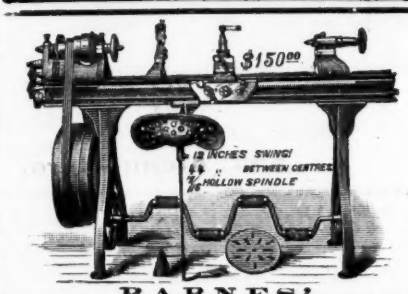

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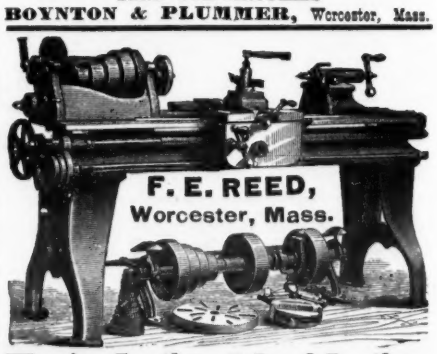

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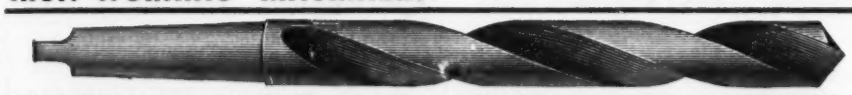

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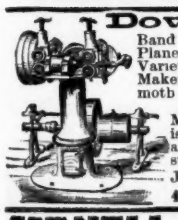

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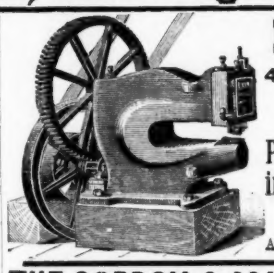

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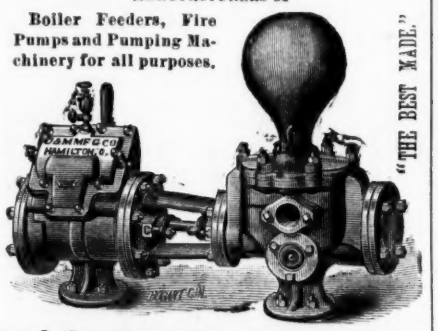

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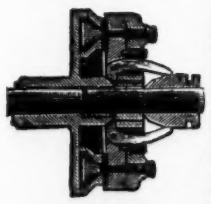

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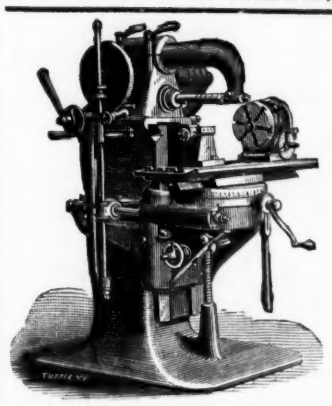

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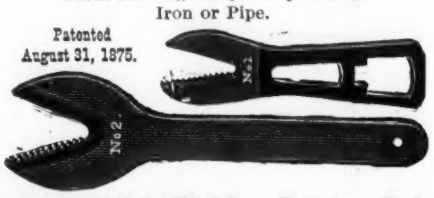

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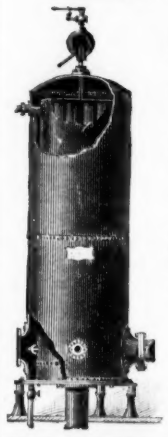

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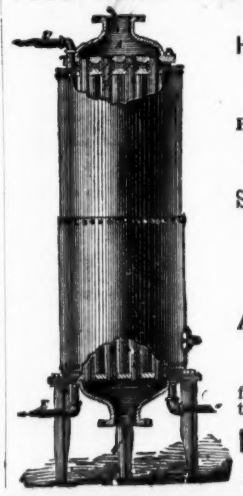

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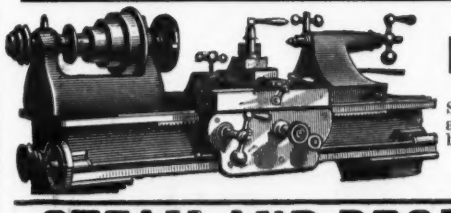

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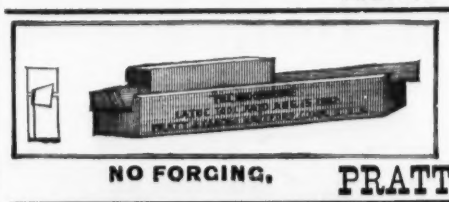

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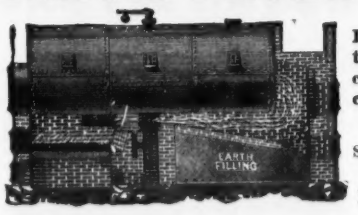

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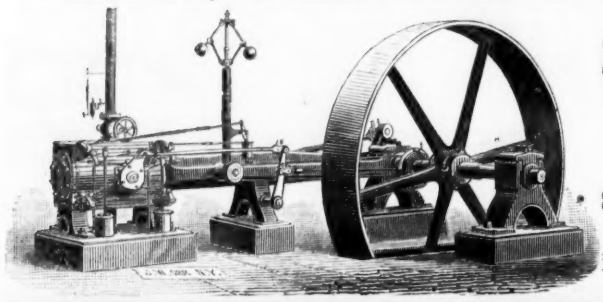

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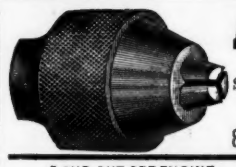

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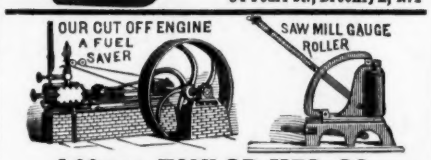

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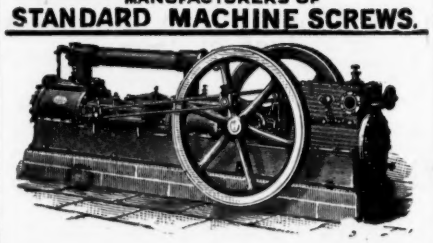

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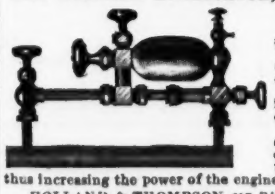

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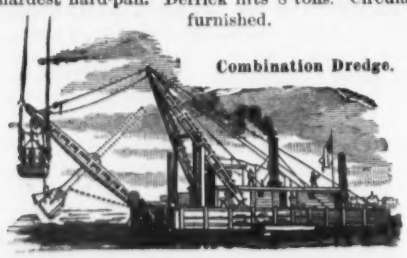

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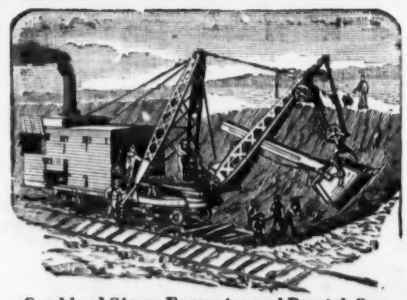

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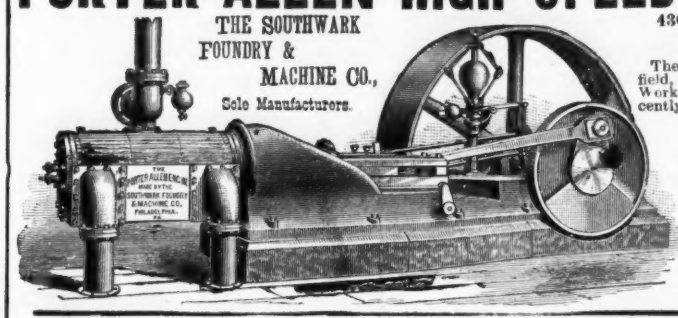

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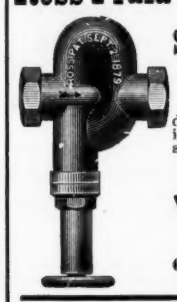

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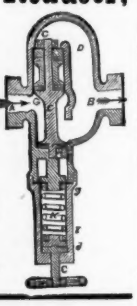

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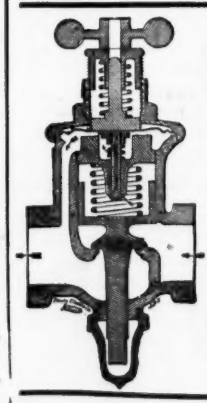

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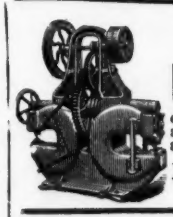

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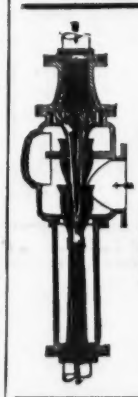

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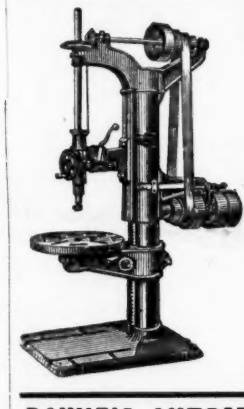

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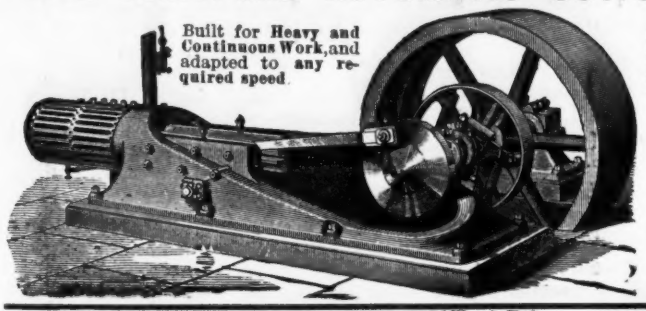

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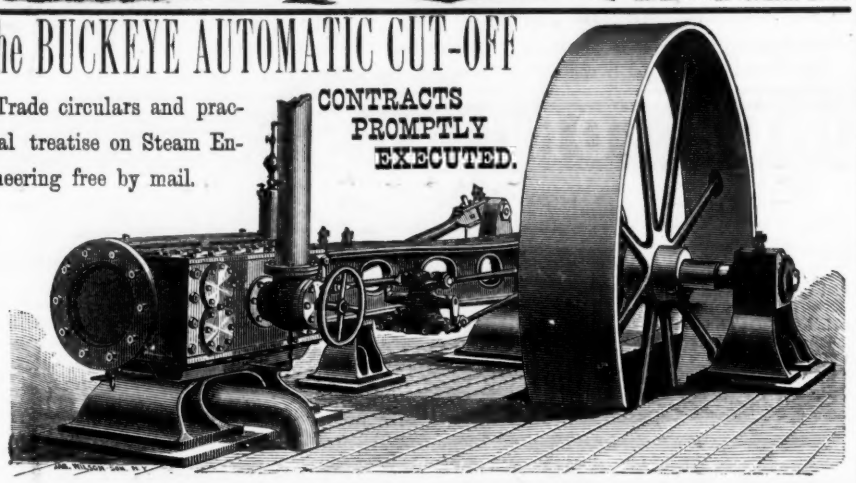

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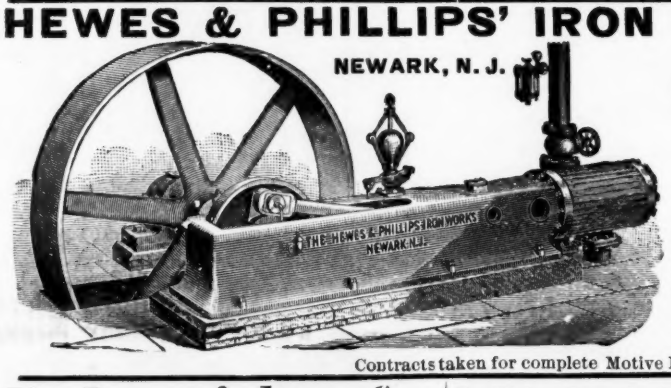

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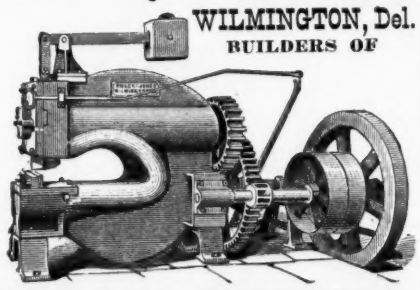

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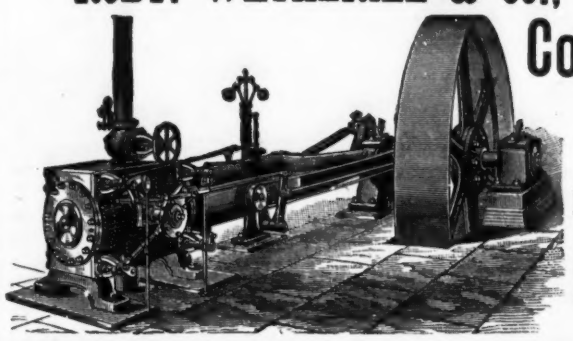

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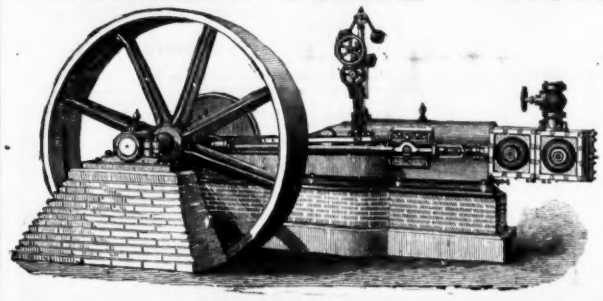

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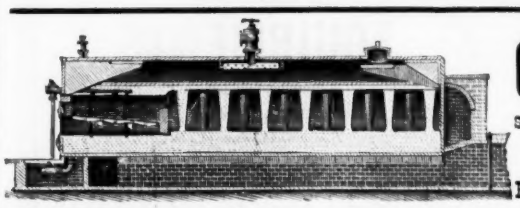

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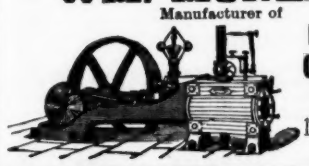

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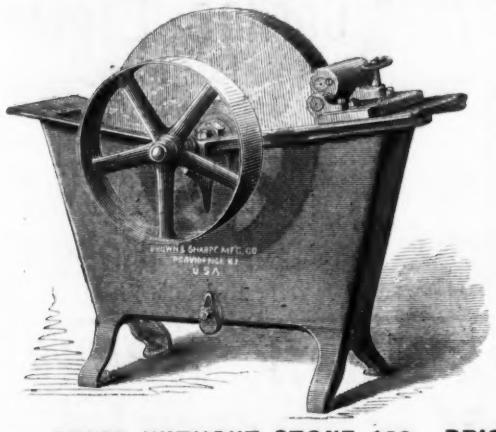

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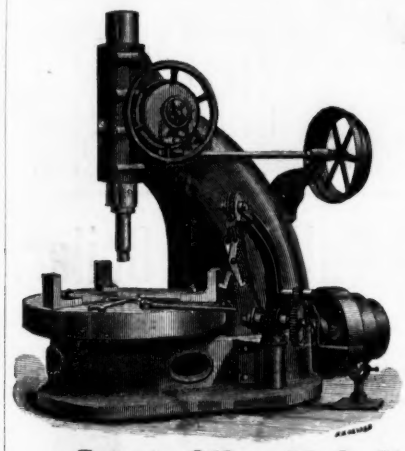

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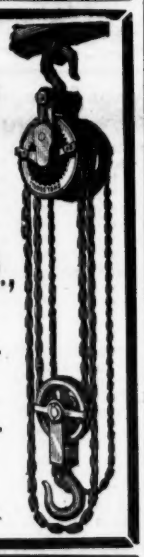

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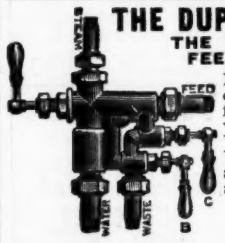

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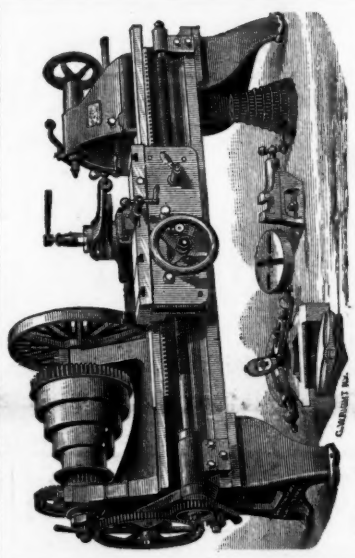

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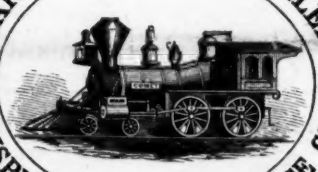

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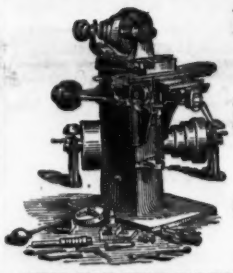

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